U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
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EXPERIMENT STATION RECORD

VOLUME XLV

JULY–DECEMBER, 1921

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

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EXPERIMENT STATION RECORD.

VOL. 45. JULY, 1921. No. 1.

From the viewpoint of agricultural education, the exercises at the Massachusetts Agricultural College in commemoration of the fiftieth anniversary of the graduation of its first class of students were among the outstanding events of the recent Commencement season. This college, though not the earliest in the field of higher education in agriculture in this country, has always been regarded as among the pioneers. Likewise, its unique position in the land-grant college group as the only institution established under the Morrill Act not charged with instruction in the mechanic arts has made its history and development of special interest. In a general way its problems, difficulties, and achievements may be regarded as typical of the American agricultural college as a distinctive institution. The completion of its first half century was therefore less a local than a national occasion, and the appropriate and impressive observance of it a matter of deep gratification and pride to every friend of agricultural education.

The success of the celebration must be attributed in no small degree to the well-conceived and thorough preparations which had preceded. The matter had been under advisement for some time, for the original intention had been to observe the fiftieth anniversary of the opening of the college to students by an elaborate celebration in the fall of 1917, and considerable had been accomplished when the entry of this country into the war caused the postponement of the enterprise. Upon the cessation of hostilities the project was revived and with some modifications carried out most successfully.

Under the plans adopted, a celebration was projected continuing over an entire academic year and culminating in special exercises at the 1921 Commencement. One distinctive feature of this "year of jubilee" was the cooperation of the college in a series of conferences on various phases of the development of agriculture and country life. This part of the program included meetings at or near the college of several national bodies, such as the American Country Life Association, the American Civic Association, the American Association of Agricultural College Editors, and the Association of Land Grant Colleges; a conference at the time of the dedication of the Women's Building on the relation of women to

country life; the first student conference of the International Association for Agricultural Missions; and gatherings of a considerable number of State organizations. These meetings brought the work of the college prominently before a large number of people of varied interests from all over the country as perhaps no other agency could have done, and illustrated some of the broader opportunities for leadership open to this type of institution.

Another phase of the celebration was the preparation and issue under college auspices of a series of semicentennial publications, "dedicated to the men of the college who by wise and generous service have helped the institution to the position which it holds to-day." The first of these publications, completed some time ago, was a brief history of the institution during its first half century, and another a graphic account of the college during the late war. A third volume, still in preparation, is to comprise a bibliography of all publications of the faculty, alumni, and others connected with the institution. These volumes will serve to collect and preserve data of great value which without the stimulus of a specific occasion might have become hopelessly scattered. Their compilation was an inspiration for which the college is to be congratulated.

The climax of the celebration, however, was the five-day program at Commencement. Fostered by systematic advance efforts to bring back to the campus every available alumnus and friend of the college, and favored by nearly ideal weather conditions, Commencement week was above all a veritable home-coming. Over forty per cent of the living alumni were registered, many from far distant points and of classes long out of college, and the total attendance exceeded three thousand persons. This response was in itself most stimulating and encouraging.

The exercises opened on June 10, which had been designated Citizens' Day, and was devoted primarily to the relations of the college to the State and Nation. The Federal Government was represented on this program by the Secretary of Agriculture, the only participant in the entire celebration who had not been previously connected with the college in some capacity. The spokesmen for the State of Massachusetts were its Governor, who is also ex-officio president of the board of trustees, and the State Commissioner of Agriculture.

The address of Secretary Wallace took up, first of all, the significance of the initial fifty years in the life of an institution, as the period when "the ground is cleared, the foundations are laid, the superstructures are built, traditions are formed, experience is accumulated, and the guiding spirit, the soul, of the institution, is cre-

ated." This anniversary, he went on to say, could well be regarded by friends of the Massachusetts Agricultural College with feelings of deep satisfaction, for the college "has had a most worthy part in one of the greatest periods of history. It has had its full share in the development of a system of agricultural education which is the admiration of the world. On its staff have been many of the most eminent educators of their time. An astonishingly large percentage of its men have had a prominent part in the agricultural development of the Nation, and have thus multiplied many times the work which has been done here."

Secretary Wallace went on to discuss the revolutionary changes in the agricultural situation during the past half century, notably the remarkable increase in food production. This increase he attributed in part to the addition of vast areas to our cultivated land, but "much of it was due to the scientific research and inventive genius of the thousands of young men who got their inspiration and training in this and like colleges. For it is during this period that we have seen the development of agricultural science. The National Department of Agriculture was created; the State experiment stations were established; the extension system of carrying the teachings of the colleges and the discoveries of the scientists to the men on the farms was developed."

Some of the new and complex agricultural problems of the present reconstruction period were then recounted, and as a means of helping to solve them increased attention by the agricultural colleges to economic questions was strongly advocated. "Looking back, we can see now that if our agricultural colleges have failed to measure up to their greatest opportunities of service that failure is due to confining practically all of their effort to the promotion of greater production and giving so little attention to the no less important matter of agricultural economics. The farmer needs all of the training in production that the colleges can give him, but the most urgent need now is the development of an entirely new realm of organized knowledge of the economic factors which will enable him to cheapen his production and improve his distribution.

"As we plan for the future it seems clear to me that, without abating in any way our efforts in the field of scientific research, without slacking in our search for better and cheaper methods of production, it is the clear duty of the agricultural colleges of the country to give more and more attention to study and instruction in the field of agricultural economics. The mission of our agricultural colleges is not to promote agriculture at the expense of industry of commerce, nor to give the farmer the sort of an education that will place him in a position of unfair advantage over

other classes, but rather, through more scientific methods of production and less wasteful methods of distribution, enable him to better serve the Nation."

The responsibilities of the agricultural colleges toward the food supply were also brought out by Governor Cox, who as the representative of a State primarily industrial in its interests, declared that "at a late date we are coming to see that our industrial and commercial progress depends in large measure upon the development of our agricultural resources. . . . It is encouraging in the highest degree that in Massachusetts we have at last recognized the absolute necessity of promoting our agricultural welfare, and that men of vision are joining hands with practical farmers in finding the solution of the vital needs of the Commonwealth." In this connection, he warmly commended the work of the college and advocated its further development, saying that "we must look more and more to an institution of this sort for leadership in the solution of all the problems which have a bearing on the life in rural communities."

The address of Commissioner Gilbert, a graduate of the class of 1904, was entitled What Massachusetts and its Agricultural College have done for the Agriculture of the Country. Among the specific contributions he cited the pioneer work of the early settlers, the invention of the cotton gin and the development of such valuable fruits as the Baldwin apple and Concord grape by citizens of the State, the educational influence of the Massachusetts Society for Promoting Agriculture, organized in 1792, and the State Board of Agriculture, established in 1851, and in particular the work of the college and its alumni. Dr. Gilbert presented statistics showing that more than two-thirds of the 1,700 graduates are in agricultural pursuits, 28 per cent being farm operators. Especially noteworthy was the finding that 21 per cent of this large number are in "positions of recognized leadership such as agricultural college administrators and teachers, experiment station and extension leaders, officials of the United States Department of Agriculture, and the like," thus corroborating the remarks of Secretary Wallace quoted above.

Following Citizens' Day came in turn Alumni Day, largely occupied with various alumni gatherings and related activities; Dedication Day, at which time Memorial Hall was formally transferred by the building committee of the alumni to the college; Anniversary Day, the distinctive feature of which was a mass meeting for reminiscence into the past and forecast into the future; and finally the closing exercises of Commencement Day. Throughout these meetings the historical aspect of the occasion was emphasized in many ways.

Various circumstances necessitated the postponement of the elaborate pageant depicting important chapters in the college history which had been originally contemplated, but an anniversary play composed by a member of the faculty was creditably presented by the Roister Doisters, the undergraduate dramatic society. This play, based on college happenings in 1871, introduced personifications of the famous "Faculty of Four" (Clark, Stockbridge, Goessmann, and Goodell), and served to bring out quite picturesquely the background of the early days.

Further opportunity for retrospect and reminiscence was afforded in the enthusiastic mass meeting on Anniversary Day. Here the developments of fifty years in educational lines, various forms of student activities, and other directions were recounted, with a closing address by President Butterfield on The College of the Future. Significant of the progress during the half century were statistics showing an increase in number of buildings from 13 to 50, of land from 383 to 1,480 acres, of property valuation from $225,000 to $1,800,000, of annual income from $75,000 to $1,000,000, of professional staff from 10 to 140, and of students in residence from 139 to 950.

The exercises of Commencement Day were likewise of historical flavor, with the pioneer class of 1871 as guests of honor. Eight of the thirteen living graduates were present, and upon each of these an anniversary parchment setting forth the felicitations of the college was bestowed. Sharing their laurels were the 95 members of the class of 1921, as well as three recipients of the degree of Master of Science and one of that of Doctor of Philosophy.

The most impressive and in many ways the most significant service of the semicentennial was the dedication of Memorial Hall. This is a beautiful structure, built by the alumni as a student and alumni activities building in memory of the fifty-one men connected with the college who gave their lives to their country in military service during the war. Constructed at a cost of over $150,000, raised entirely by small contributions from about one thousand five hundred alumni, students, and faculty, and a few friends, this building symbolizes the patriotism and self-sacrifice embodied in the enrollment of over one thousand three hundred M. A. C. men in military or naval service during the war. Conceived soon after the cessation of hostilities, it is believed to be the first college memorial building to be completed, and constitutes a concrete fulfillment of the pledge carved upon its walls: "We will keep faith with you who lie asleep."

Very naturally, the various meetings of the celebration afforded many opportunities to discuss anew the function of an agricultural

college and the lines of development which it should pursue in the future. The unique status of the Massachusetts College in the past was referred to by the Governor, the State Commissioner of Education, and various alumni, and in several addresses by President Butterfield. As defined by Commissioner of Education Payson Smith, the institution is established and maintained by the State for "the second of the great general purposes of education, which is that of releasing for the service of the people of the State the stores of knowledge that relate to the field of agriculture, and of course in the field of experimentation for making new discoveries in the field of science and their practical application to the needs of an important basic industry." Likewise, President Butterfield pointed out that historically "from the very outset its work was limited to the field of agriculture broadly defined. Science applied to the art of agriculture became the basis for the work of the college. A thorough-going education was contemplated, but agriculture was regarded as the one real object from the beginning, and the idea has always been adhered to, although many graduates have gone into other work."

Looking toward possible developments of the future, he expressed the hope that this status would be adhered to. "However, we have rightfully and widely broadened the definition of agriculture to include not merely the production of plants and animals, but their distribution, conservation, and ultimate use. We are a food supply college." This conception of a "food supply college," an "instrument of education intended to help solve the whole problem of food supply" he maintained would mean a vast enlargement of investigational and extensional activities and the training of men for many new occupations.

Speaking from the broader standpoint of the land-grant colleges of the United States, President W. E. Stone of Purdue University, a graduate of the class of 1882, defined the function of these institutions as "continuously to interpret and correlate the progress of science with the basic industries by training the men who shall serve the industrial world as its leaders, operators, investigators, and teachers. . . . In their student bodies composed of young men and women largely from the middle classes and imbued with the American traits of energy and industry; in their curriculum touching the scientific foundations of industry, transportation, and communication; in their research departments occupied with the solution of concrete, practical problems of the farm and agriculture; in their extension service carrying helpful knowledge and advice to the farm, the factory, and the home; in their provision for elementary military training for national defense; in their latest developments

touching social and economic conditions in rural life; in their close cooperation with all forward looking movements and agencies to improve the Nation's fundamental industries, these colleges are in the highest degree service institutions, educational at the foundation, but extending their services and reaching the life and welfare of the people in a thousand concrete ways."

An occasion such as this with its review of history, its retrospect of difficulties encountered and overcome, its survey of what has been accomplished, and especially its forecast of a future of higher ideals and greater usefulness, has large significance and helpfulness to an institution, and scarcely less so to the group of institutions of which it is a part. In carrying out so sucessfully its worthy and dignified semicentennial celebration, the Massachusetts Agricultural College has rendered a real service to the land-grant colleges of the Nation, for as President Stone pointed out, "the half century of vicissitude, of effort, and of achievement which Massachusetts Agricultural College celebrates has in some degree been experienced by all of her sister institutions." The recognition, the appreciation, and the inspiration which it received through its anniversary observance can not fail to be stimulating and helpful to the cause of agricultural education as a whole.

Another 1921 Commencement program warranting special mention was that of the University of Tennessee from June 5 to 8. The exercises held at this institution centered around the dedication of two imposing buildings, just completed as the beginning of a comprehensive building project. The distinctive feature of the program was a series of State conferences of various groups on the promotion of efficient citizenship.

The two new buildings constitute notable additions to the university equipment. Ayres Hall, the larger structure, is to be used primarily as a liberal arts building, and architecturally is the dominant structure on the campus. Named in honor of former President Brown Ayres, well known among American educators through his long service to the institution, it will provide class rooms and other accommodations for nearly two thousand students, including facilities for the College of Agriculture in the basic sciences and humanities. Eventually, the hope is to supplement it with an administration building and a large auditorium, the latter to be given by the alumni association as a war memorial.

The second building, to be known for the present simply as the agricultural building, is likewise a large and modern structure, occupying a commanding location on the university farm. It will house the administrative officers of the College of Agriculture, the

station, and the extension division, together with laboratories, lecture rooms, and offices for the departments of horticulture, agronomy, animal husbandry, veterinary science, dairying, botany, and agricultural economics. This building will serve as the nucleus of a projected agricultural group.

The dedicatory exercises for these two handsome structures were well attended and impressive. The principal speakers were for Ayres Hall, Hon. P. P. Claxton, formerly United States Commissioner of Education, and for the agricultural building, President W. O. Thompson, of Ohio State University. The speech of Dr. Claxton dealt with the relations of the university and the State, while that of President Thompson discussed the achievements and functions of the land-grant colleges of the country.

The conferences on citizenship were held in the new agricultural building and attracted an attendance of several hundred persons. The plan of organization was in ten groups, including agriculture, commerce and industry, finance, civil administration, law, medicine and dentistry, the press, the home and social welfare, church educational work, and education. These groups discussed in detail the need and scope of a citizenship program for the State and ways in which the university could assist in such a program. Marked interest is reported to have been taken by the remaining groups in the results already accomplished along research and extension lines in agriculture, and endorsement was given to similar undertakings in other directions. Strong support to the university program was pledged and a permanent organization effected to aid its cause.

The representative and influential attendance at these conferences showed in a very gratifying way how fully the State as a whole is interested in this institution. It was clearly brought out that the establishment of experiment stations in Middle and West Tennessee and the extension work in agriculture and home economics had been very important factors in bringing about this State-wide support of the university, which makes its future so promising.

As in the Massachusetts celebration, the Tennessee Commencement attracted wide attention. The Governor and other high officials of the State were represented and wide publicity was given the exercises, demonstrating anew how completely in North and South alike the land-grant colleges have become accepted and honored members in our educational system.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The globulin of the cohune nut, Attalea cohune, C. O. JOHNS and C. E. F. GERSDORFF (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 57–67, pl. 1*).—The authors at the Bureau of Chemistry, U. S. Department of Agriculture, have analyzed the globulin of the cohune palm nut, which is now being utilized in British Honduras for its oil. The press cake obtained by cold expression of the oil was found to contain 20.63 per cent of protein. By dialysis of a saline extract of the press cake or by precipitation with ammonium sulphate, a globulin was obtained quite similar to that obtained from the coconut as shown by its elementary analysis and by its amino nitrogen distribution, which was as follows: Amid N 7.5 per cent, humin N adsorbed by lime 0.84, humin N in amyl alcohol extract 0.11, cystin N 0.53, arginin N 30.87, histidin N 2.61, lysin N 7.94, amino N of filtrate 47.87, and nonamino N of filtrate 2.28 per cent. The distribution of the basic amino acids was cystin 0.81 per cent, arginin 17.17, histidin 1.72, and lysin 7.42 per cent. A trace of albumin was obtained, the albumin coagulating between 60 and 68° C. and the globulin coagulating near the boiling point of water.

The authors conclude that the cohune nut press cake will be suitable for use in feeds.

Review of the literature on ethereal oils and perfumes published during 1914–1918, G. PELLINI (*Gior. Chim. Indus., 1 (1919), Nos. 3, pp. 119–126; 4, pp. 178–188*).—This is a compilation from the literature of data on the analytical constants of various ethereal oils and perfumes, together with statistics on the importation and exportation of these oils in Italy during the years covered.

The fermentation of xylose by bacteria of the aerogenes, paratyphoid B, and typhoid groups, E. B. FRED and W. H. PETERSON (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 539–549*).—Following the methods used in previous studies of the fermentation of xylose and other carbohydrates by pentose-fermenting bacteria (E. S. R., 44, p. 610), a study was made of the products of the fermentation of xylose by bacteria of the aerogenes-typhoid group including culture 26, *Bacillus lactis aerogenes*, *B. typhosus*, and *B. paratyphosus* B.

Xylose was readily fermented by the organisms of the aerogenes and the paratyphoid groups with the rapid evolution of gas. The products of fermentation with *B. lactis aerogenes* were carbon dioxid, hydrogen, and alcohol, with small amounts of volatile acids; with *B. paratyphosus* B, formic, acetic, butyric, lactic, and succinic acids, ethyl alcohol, carbon dioxid, and hydrogen. About 75 per cent of the sugar was consumed in the former and about 92 per cent in the latter case. The fermentation of xylose by the typhoid bacteria was very incomplete, not more than one-fourth of the xylose being decomposed. No gaseous products were formed except small amounts of carbon dioxid. The chief products of the fermentation were formic, acetic, butyric, and succinic acids, the latter in the largest amounts.

Contribution to the study of the enzym indices of the blood.—Determination of catalase, peroxidase, and esterase in a drop of blood, A. BACH

and S. Zoubkoff (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 20, pp. 967–969*).—Methods are described for determining catalase, peroxidase, and esterase in minute quantities of blood, one drop of blood dissolved in 20 cc. of water being sufficient for the three determinations.

The average, maximum, and minimum values for catalase in 40 observations on blood obtained from a single subject in a period of three months were, respectively, 17.8, 18.78, and 17.17 mg. of H_2O_2 decomposed by 0.001 cc. of blood. Corresponding results for oxidase were 0.121, 0.153, and 0.096 mg. of guaiacol oxidized, and for esterase 0.131, 0.147, and 0.108 mg. of guaiacol set free and oxidized.

The distribution of inorganic iron in plant and animal tissues, H. W. Jones (*Biochem. Jour., 14 (1920), No. 5, pp. 654–659*).—Various plant and animal tissues were examined for inorganic iron by staining with a solution of hematoxylin in distilled water, under which conditions a deep bluish-black color is obtained with ordinary inorganic iron and a brown color with colloidal iron.

Inorganic iron was found to be quite widely distributed throughout vegetable and animal tissues. The lower plants and animals gave the reaction more strongly than the higher ones, and plant tissues as a whole more strongly than animal. In the tissues of guinea pigs the staining was more marked in the cells which immediately surround the blood vessels. Fetal tissues showed a more marked reaction than adult tissues, and placental tissues definite staining in patches in the chorionic villi and in most of the nuclei. In human blood smears sufficient evidence was not obtained to indicate the presence of inorganic iron.

The thermal death point in relation to time of typical thermophilic organisms, W. D. Bigelow and J. R. Esty (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 602–617, figs. 4*).—Attention is called to the importance, especially in the sterilization of canned foods, of knowing the conditions affecting and the time necessary for complete destruction of resistant spores at high temperatures. A method is described which is said to give accurate results for the determination of the thermal death point of heat resistant spores, and data are reported showing not only the effect of different temperatures on the time necessary to destroy a definite suspension of spores of certain typical thermophilic bacteria, but also the influence of different concentrations of the same spores in media of the same and varying H-ion concentration.

The method involves the use of the De Khotinsky electric bath with thermoregulator attachment for maintaining uniform temperatures and of special soft glass culture tubes 7 mm. (inside diameter) by 250 mm. long and with 1 mm. thickness of wall. These tubes which, after inoculation with 1 cc. of the suspension of spores prepared according to a standardized technique, are sealed off to within 2 in. of the surface of the liquid, can stand a sudden change of temperature over a wide range and reach the temperature of the surrounding medium in a few seconds. The technique of their use in the experiments reported is described in detail. From the results obtained, which are presented in tables and charts, the following general conclusions are drawn:

"The time necessary to destroy a known suspension of spores in a medium of known H-ion concentration decreases as the temperature increases.

"The H-ion concentration influences the time necessary to destroy a known suspension of spores at a given temperature. As the pH value is increased, the time required for complete destruction is decreased.

"The initial concentration of spores per cubic centimeter affects the time necessary to sterilize a medium of known H-ion concentration at a given temperature. The larger the number of spores present in a medium, the longer the time necessary to destroy them."

Preparation of collodion sacs for use in bacteriology, F. L. GATES (*Jour. Expt. Med., 33 (1921), No. 1, pp. 25–43, figs. 7*).—A standardized method is described in detail for the preparation of collodion sacs suitable for intraperitoneal incubation and for other bacteriological experiments. These sacs are said to be "permeable to gases in solution, to inorganic salts, to dextrose, to certain protein-split products which are nutritive to bacteria, and to certain toxic products of bacterial metabolism, but they hold back antibodies, unsplit proteins, and formed elements such as bacteria and body cells."

A mechanical measuring instrument for sterile liquids, F. L. GATES (*Jour. Expt. Med., 33 (1921), No. 1, pp. 45–49, figs. 4*).—In the instrument described, which was first devised as a substitute for the graduated pipette in immunological tests, the principle involved is the displacement of the required amount of liquid by an equal volume of air at atmospheric pressure. The air is measured by a graduated syringe set to deliver any amount within its capacity. Before coming in contact with the liquid the air is twice filtered through cotton plugs, thus eliminating contamination.

The determination of hydrogen ions, W. M. CLARK (*Baltimore: Williams & Wilkins Co., 1920, pp. 317, pls. 2, figs. 37*).—This volume consists of a detailed exposition of the two methods in common use for the determination of H-ion concentration, viz, the electrometric method involving the use of the hydrogen electrode, and the colorimetric method utilizing the color standards of Clark and Lubs, Sørensen, and others. Each of these methods is discussed from the standpoint of theory and practice, concise directions being given for the application of the method in all its details. In the section on the colorimetric procedure a color chart by M. Broedel, reproducing the colors of Clark and Lubs' indicators in solutions of known pH, is given. The chapters on the hydrogen electrode method, to which of necessity considerable more space is given than to the colorimetric method, are abundantly illustrated with diagrams of various types of hydrogen electrode apparatus and potentiometers.

Chapters are also included on the standardization of pH measurements and on supplementary methods of determining H-ion concentration, and, for the benefit of those to whom the subject is new, a final chapter is devoted to a running summary of some of the principal applications of H-ion concentration determinations. This is written in the form of an index to the extensive bibliography which follows. Necessary tables for use in H-ion concentration determinations are assembled in an appendix.

A volumetric determination of potassium and its application to the analysis of fertilizers, G. AJON (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 8, pp. 422–426*).—A volumetric method of determining potassium in commercial chlorids and sulphates is described which depends upon the precipitation of the potassium as sodium potassium tartrate by tartaric acid and sodium hydroxid in the presence of alcohol, the excess of the reagents being titrated with N/10 NaOH in 96 per cent alcohol, using phenolphthalein as an indicator.

Gasometric determination of nitrogen and its application to the estimation of the nonprotein nitrogen of blood, R. L. STEHLE (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 223–228*).—The author suggests the use of the Van Slyke apparatus for the determination of CO_2 of blood plasma (E. S. R., 37, p. 804) for gasometric nitrogen determinations of urea, etc., with the use of hypobromite. The procedure is as follows:

The sample is digested with as small an amount of concentrated H_2SO_4 as possible and a small crystal of $CuSO_4$, and after cooling is diluted and made up to 100 cc. or some definite volume. A definite quantity, preferably 10 cc., is placed in the Van Slyke apparatus, and the dissolved air is expelled by reducing

the pressure. Sufficient alkali is then added to neutralize the H_2SO_4, followed by 2 cc. of the standard hypobromite solution. The pressure is reduced and the apparatus shaken for about a minute to completely liberate the nitrogen. To prevent liberation of oxygen from a possible excess of hypobromite, a small amount of sodium pyrogallate solution is run into the reaction chamber as soon as the decomposition of the ammonium salt is over. The volume of nitrogen is best read by making the volume of the gas exactly 1 cc. and measuring the pressure necessary to accomplish this. Corrections should be made for the nitrogen content of the hypobromite solution and, if great accuracy is required, for the quantity of nitrogen dissolved in the final solution.

Comparative results obtained by the above method and the Kjeldahl procedure in nitrogen determinations with sodium sulfanilate, casein, uric acid, dried milk, and urea are reported. While not having the accuracy of the Kjeldahl method, the new procedure is considered to give results of ample accuracy for many purposes and to have the advantage of being much more rapid.

Directions are also given for the application of the method to the determination of the nonprotein nitrogen of blood, using the tungstic acid precipitation method of Folin and Wu for obtaining a protein-free blood filtrate.

Determination of glucose and starch by the alkaline potassium permanganate method, F. A. QUISUMBING (*Philippine Jour. Sci., 16 (1920), No. 6, pp. 581–599, figs. 6*).—The author reports a study of the conditions essential to the accurate estimation of glucose and starch by the alkaline potassium permanganate method, and describes a technique by means of which results have been obtained which are said to be of an accuracy equal to that of volumetric Fehling determinations. The standardized procedure for the determination of glucose is as follows:

Fifty cc. of N/10 potassium permanganate solution, 25 cc. of a solution of sodium carbonate containing 8.48 gm. of anhydrous sodium carbonate per liter, and 25 cc. of the glucose solution (which should not contain more than 40 gm. of glucose) are placed in an Erlenmeyer flask, which is then placed on a special heating device so regulated that the temperature is raised from 29 to 95° C. in 2 minutes. The flask is heated for exactly 2 minutes after the temperature has reached 95°, after which it is removed, 25 cc. of 28 per cent H_2SO_4 and 25 cc. of N/10 oxalic acid solution are added, and the excess oxalic acid is titrated against N/10 potassium permanganate until the liquid assumes a pink color which remains for a few seconds. The calculations are made from a table of standards of glucose and starch.

In applying the method to starch analysis the washed sample is first hydrolyzed with sulphuric acid. When flour is to be analyzed it should be hydrolyzed by the saliva or diastase method, as the results by the permanganate method are about 10 per cent higher after acid hydrolysis of the flour.

A volumetric method for the determination of lactose by alkaline potassium permanganate, F. T. ADRIANO (*Philippine Jour. Sci., 17 (1920), No. 2, pp. 213–220*).—The method noted above has been applied to the determination of lactose in milk with the use of lactose permanganate tables similar to those for glucose and starch. Comparative results are reported of lactose determinations with the permanganate method and the optical and Soxhlet methods on samples of diluted evaporated milk, fresh and sterilized cow's milk, and a synthetic milk prepared in the laboratory by mixing the necessary proportions of water, butter, casein, pure lactose, ash, and water.

The percentages of lactose given by the optical method were consistently lower than by either of the other methods, and the Quisumbing method gave slightly lower results than the Soxhlet. The differences between the polari-

scope, and the two oxidation methods were greater in the case of the sterilized evaporated milk than in that of fresh or sterilized cow's milk. This is thought to be due in part at least to chemical changes affecting polarization occurring in the milk during the process of evaporation.

The author concludes that the results obtained by the polariscope method are unreliable, particularly in the analysis of canned milk. Where a high degree of accuracy is required either the Quisumbing or the Soxhlet method should be given preference, the former being the more rapid of the two.

Lactose—Determination of in milk by colorimetric method, R. G. Owen and R. Gregg (*Jour. Lab. and Clin. Med., 6 (1921), No. 4, pp. 220, 221*).—The method described is an adaptation to lactose of Folin's latest method of determining blood sugar (E. S. R., 42, p. 712). The technique is as follows:

To 1 cc. of milk in a 100 cc. flask is added 2 cc. of 10 per cent sodium tungstate and, drop by drop, 2 cc. of 2 N/3 H_2SO_4. After standing for 5 minutes the mixture is diluted to 100 cc. and filtered. One cc. of the filtrate and 1 cc. of water are placed in a Folin special sugar tube, and to this tube and two others containing as standards 2 cc. of a solution containing, respectively, 0.5 gm. and 0.7 gm. of pure lactose are added 2 cc. each of alkaline copper solution. After standing in boiling water for 6 minutes the tubes are placed in cold water until cooled. Two cc. of the Folin molybdate phosphate solution is then added to each tube, and after standing a few minutes the three solutions are diluted to 25 cc. and compared in the colorimeter. It is said that the figures obtained with the above method agree closely with those of the Folin titration method.

Rapid method for the determination of fat in flour, bread, etc., E. Vautier (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 10 (1919), No. 1, pp. 40–44*).—For the rapid determination of fat in cereal products, the author suggests heating for 5 minutes at boiling temperature 1 gm. of the thoroughly dried and powdered sample with HCl, 1:1, in special centrifuge tubes, adding a mixture of equal parts of petroleum ether and ether, shaking for 5 minutes, centrifuging for 10 minutes, and finally decanting an aliquot of the clear liquid, evaporating the solvent and weighing the residue.

Studies on the determination of the egg content of food materials by means of the precipitin reaction, J. Thoni (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 10 (1919), No. 1, pp. 1–26, figs. 4*).—A study of the accuracy of the precipitin reaction with egg white and egg yolk in the fresh and dried state is reported, which shows that the method can be used for the quantitative determination of both in the fresh state, but that in dry and old products it is suitable only for egg white preparations. The technique of the method as applied to the determination of the latter is described in detail.

Examination of meat and meat products, P. A. van Driest (*Tijdschr. Diergeneesk., 47 (1920), Nos. 1, pp. 8–19; 2, pp. 37–51*).—Following a brief review of the literature on methods of detecting spoilage in meat and meat products, tables are given of the results obtained in the examination of sausages, cured meats, etc., by the determinations of acidity, ammonia, and amino acids, the latter by the formol titration method of Sørensen. While sound products gave varying results for these determinations, the formol and ammonia numbers were much higher in the spoiled than in the sound products.

The detection of coumarin in vanillin, L. Geret (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 11 (1920), No. 2–3, pp. 69–71*).—The author suggests the use of a solution of iodin in potassium iodid (1 per cent iodin and 2 per cent potassium iodid) to detect the presence of coumarin in vanillin. With a saturated water solution of vanillin this reagent gives only the natural yellow color, but with a saturated solution of coumarin dark blue iridescent

crystals resembling free iodin are formed. Modifications of the test to be used with solids or saturated solutions are described.

The salt or sodium chlorid content of feeds, G. S. Fraps and S. Lomanitz (*Texas Sta. Bul. 271 (1920), pp. 5–14*).—This publication includes a description of a rapid method for determining chlorids in feeds and the results of a study of the chlorid content of materials used in mixed feeds. The technique of the method is as follows:

Weigh 5.85 gm. of the feed into a 200 cc. volumetric flask, make up to volume with water, and let stand for an hour, shaking the flask 3 or 4 times during this interval. Pour off 70 to 80 cc. into a dry Erlenmeyer flask and add 1 gm. of carbon black or of dry lead acetate, giving the flask a rotary motion to mix the contents. After letting the flask stand for an hour with occasional stirring, filter the contents through a dry 11-cm. filter into a dry 6-oz. bottle, rejecting the first few cubic centimeters of the filtrate. Pipette 5 cc. of the filtrate into a beaker, make slightly acid with dilute nitric acid, and add from a burette with thorough stirring an excess (usually 5 cc.) of N/10 silver nitrate solution followed by 5 cc. of a saturated solution of ferric alum, and 10 cc. of nitric acid prepared by boiling a mixture of 1 part water to 3 parts concentrated HNO_3 until colorless. Finally titrate the excess silver nitrate with N/10 thiocyanate solution, the end point being marked by the appearance of a light brown to reddish color through the beaker. Tests of the method by checking the recovery of known amounts of NaCl added to feeds, by comparing filtering off the silver chlorid as recommended in the Volhard procedure with nonfiltering, and by comparing the method with the Official method of ignition with Na_2CO_3 on the same feeds, are reported, the results of which show that the short method is satisfactory from an analytical standpoint.

For the purpose of detecting added salt in feeds determinations by the Official method were made and are reported of the chlorids calculated as NaCl in a large number of simple and mixed feeds. The salt content of individual feeds was low in all except molasses, alfalfa, and packing house products, the molasses and alfalfa feeds containing about 1 per cent salt. It is thought that the added salt of a mixed feed may be approximately estimated by subtracting 1 per cent of the alfalfa and molasses present from the chlorids calculated as NaCl or by comparing the chlorid content with the average salt content of the ingredients.

Determination of coagulable protein in serum, W. N. Berg (*Jour. Lab. and Clin. Med., 6 (1921), No. 4, pp. 223–226*).—The author, in the Bureau of Animal Industry, U. S. Department of Agriculture, has devised a technique for the determination of coagulable protein in small amounts of dilute serum by direct precipitation with N/50 acetic acid.

The method calls for the use of specially made 1 cc. pipettes 250 mm. long and graduated into 0.01 cc., heavy glass centrifuge tubes of a maximum capacity of 13.15 cc. and a medium sized motor-driven centrifuge which is run at 2,400 revolutions per minute for 20 to 25 minutes during a determination. Into each of three clean weighed tubes is pipetted 0.5 cc. of serum, which is then diluted with 9 cc. of distilled water measured from a burette. The tubes are heated until hot to the hand, and the N/50 acid is gradually added to neutralize the alkalinity of the serum. When the precipitate formed as the acid is added no longer dissolves on rotating the tube, the tube is heated almost to a boiling temperature and allowed to stand a few minutes, after which it is centrifuged, the supernatant liquid is poured off, and the tubes are drained well, cleaned on the outside, and dried to constant weight in a vacuum desiccator.

In the series of 9 determinations of total solids and ash in the precipitates obtained from tetanus antitoxin, plasma, and serum, the coagulable protein thus precipitated amounted to an average of 91.4 per cent of the solids not-ash.

Determination of chlorids in blood, A. S. WETMORE (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 113–118*).—The method proposed, which can be used with either whole blood or blood plasma, is based on the precipitation of protein by copper hydroxid and of the oxalate and part, if not all, of the phosphate by an excess of calcium hydroxid, and on the titration of the chlorids by the procedure of Rappleye (E. S. R., 39, p. 807). The technique of the procedure is described, and the results are reported of a comparison of this method with the Van Slyke-Donleavy (E. S. R., 40, p. 714) and other methods.

A method for the estimation of lactic acid in blood, G. A. HARROP, JR. (*Soc. Expt. Biol. and Med. Proc., 17 (1920), No. 7, pp. 162, 163*).—The method described is based upon the conversion of lactic acid into acetaldehyde in the presence of concentrated H_2SO_4, and the development of a color reaction with guaicol which can be estimated by comparison with standards in Nessler tubes or in a Duboscq colorimeter.

The adsorbent power of Norit compared with that of blood charcoal, H. R. KRUYT and C. F. VAN DUIN (*Rec. Trav. Chim. Pays-Bas, 4. ser., 39 (1920), No. 9, pp. 679–684, fig. 1*).—To determine the comparative adsorptive powers of Norit and blood charcoal, the isotherms of adsorption for the two substances were determined with combinations of ions of very different character, including the OH-ion of NaOH, the H-ion of HCl, phenol, and the sodium salt of *p*-sulfocinnamic acid, as representatives, respectively, of easily adsorbed organic and inorganic ions. Blood charcoal purified with acid was found to have a stronger adsorbent power for all these ions than either commercial Norit or Norit purified by boiling with dilute HCl and with water.

Commercial utilization of waste seed from the tomato pulping industry, J. H. SHRADER and F. RABAK (*U. S. Dept. Agr. Bul. 927 (1921), pp. 29, figs. 11*).—This supplements Bulletin 632 (E. S. R., 38, p. 807) by describing in detail the commercial methods involved in the handling of the material from the time the wet waste leaves the pulping machine until the finished product is ready for the market. The two important steps in preparing tomato seed for oil production, namely, the separation of the seed from the wet waste material and the drying of the seed, and the pressure and solvent methods for extracting the oil from the seeds are described in detail with illustrations and diagrams of the machinery employed.

Estimates on the cost of separating, assembling, drying, and crushing the seed, together with the cost of the necessary equipment, are reported. These indicate considerable profit provided the seed is separated and dried at the various pulping stations and shipped to central points where the oil, cake, and meal can be manufactured.

"The utilization of an agricultural waste of this character for the production of commodities of much commercial value is suggested as a conservation measure worthy of careful consideration."

Manufacture of ethyl alcohol from wood waste, E. C. SHERRARD (*Chem. Age [New York], 29 (1921), No. 2, pp. 76–79*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., consists of a brief description of the process, plant requirements, and cost of the manufacture of ethyl alcohol from wood waste by hydrolysis with dilute acid under pressure.

METEOROLOGY.

Temperature variations in the United States and elsewhere, A. J. HENRY (*U. S. Mo. Weather Rev., 49 (1921), No. 2, pp. 62–70, figs. 3*).—This article is based on a study of the 12-month consecutive or overlapping monthly means of

temperature for the New England States, Minnesota, Colorado, Washington, and Louisiana. In order to get beyond the influence of the secondary circulation due to cyclones and anticyclones the study was extended to include certain tropical stations, namely, Batavia, Habana, Honolulu, and Arequipa.

It was found that there is practically a continuous oscilltion of temperature up and down of varying magnitude and duration, and that these oscillations are often concurrent over large areas of the earth's surface, although they may or may not be in the same sense. The oscillations generally appear to occur and recur without order or in any systematic way. The preponderance of evidence points to a period of about 40 months, or one-third of a sunspot cycle, as being the one most commonly experienced.

There appears to be "a lack of synchronism in the variations in sunspots and terrestrial temperatures, which suggests that the two events may not stand in the relation of cause and effect, but that both events may be due to a common, at present unknown, cause. The temperature variations in the United States east of the Rocky Mountains and above north latitude 40° are so directly controlled by the secondary circulation as to render futile any attempt to forecast the character of the season in advance. On the Pacific coast and in the zone south of north latitude 40° the outlook is more hopeful. The amplitude of the variations in terrestrial temperature that may be due to sunspots is small, less than 1° C. on the average in the Tropics and diminishing thence toward the poles. In the United States the range from the year of highest temperature at sunspot minimum, 1900, to the year of lowest temperature in a year of spot maximum, 1917, amounted to 2.5° F. (1.4° C.)."

Sequence of winters in the northeastern United States, C. F. Brooks (*U. S. Mo. Weather Rev., 49 (1921), No. 2, pp. 71–74, fig. 1*).—"A study of the sequence of mean winter temperatures since 1812 in the northeastern United States shows apparently no other than a chance relationship four-fifths of the time. The other fifth includes two remarkable series of alternating cold and warm winters, with almost identical preliminaries of a few moderately mild winters, an ordinary or moderately cold winter, and then a severe winter, which opens the alternating series—severe, warm, severe, warm, etc. The opening severe winters in these two series were those of 1872–73 and 1917–18. Thus we examine with interest the records of the winters of 1876–77, 1877–78 . . . , 1882–83, and wonder whether the winters of 1921–22, 1922–23 . . . , 1927–28 will alternate cold, warm, cold, etc., as those of 45 years ago did for such a long period. A study of the weather maps of these winters of the seventies and eighties in conjunction with those of the past few years and of the present might show not only the immediate cause of these alternating winters, but also might give us a hint as to when to expect our present series of alternations to cease."

The article is briefly discussed by H. W. Clough.

Are the seasons changing? C. J. Root (*U. S. Mo. Weather Rev., 49 (1921), No. 1, p. 24*).—A review by decades of records of temperature at New Haven, Conn., from 1780 to 1920, inclusive, seems "to indicate very clearly that since the Revolutionary War at least, there has been no permanent change of temperature."

Weather and crop yields in the United States, C. F. Brooks (*Geogr. Rev., 11 (1921), No. 2, p. 295*).—This is a brief review of a number of recent contributions to this subject including those of Wallace, Blair, Smith, and others (E. S. R., 44, pp. 118, 414, 507.)

Investigations on soil air, P. B. Huber (*Arch. Sci. Phys. et Nat. [Geneva], 5. ser., 2 (1920), pp. 508–510; abs. in Sci. Abs., Sect. A–Phys., 24 (1921), No. 279,*

pp. 165, 166).—Observations over a gravelly soil are recorded which showed that ionization of the surface air was greater over dry soil than over wet, and greater over loose soil than over compact. It was practically nil over snow. This agrees in general with results reported by Alujic in observations over clay soils, although the absolute values appear to be higher over gravel than over clay soil. The emanations content appears to depend upon the character of the soil.

It was found that the high ionization of the air occurring during the foehn "is not due solely to the descent of strongly ionized air from higher levels, but that at the same time the emanations from the surface are above normal. Other cases of strong ionization are mentioned, which on investigation proved to be confined to a layer 20 to 30 meters above the surface, the ionization at 50 meters being normal. This condition is observed to precede a change of weather."

The observations upon which this article is based were made with a cylindrical sheet-iron receiver 30 cm. wide and high, open at the base, and with a hole about 8 cm. in diameter at the top, through which an electrometer was connected with a plate 15 cm. in diameter and 15 cm. from the ground.

Monthly Weather Review (*U. S. Mo. Weather Rev., 49 (1921), Nos. 1, pp. 52, pls. 18, figs. 8; 2, pp. 53–114, pls. 18, figs. 23*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for January and February, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 1.—The Meteorology of the Temperate Zone and the General Atmospheric Circulation (illus.), by V. Bjerknes; The Rapid Fall in Temperature of Cold Waves; Balloon Racing—A Game of Practical Meteorology, by R. H. Upson; Meteorological Aspects of the International Balloon Race of 1920 (illus.), by C. G. Andrus; The Application of Bjerknes Lines to the Development of Secondary Lows (illus.), by C. G. Andrus; Origin of Some Secondary Cyclones on the Middle Atlantic Coast (illus.), by C. F. Brooks; Note on Deep Easterly Winds Over the Middle West on January 24, 25, and 26, 1921 (illus.), by L. T. Samuels; Ice Storm and Gale of January 25–27 at Wilmington, N. C., by R. M. Dole; Dust Cloud Over Drexel, Nebr., January 15, 1921, by H. L. Choate; Further Evidence as to the Western Origin of Dust which Fell in Central States, February 12–15, 1919; Note in Regard to the Clinging Qualities of Snow, by J. R. Weeks; Our Involuntary Climatic Travels (illus.), by J. B. Kincer; Severe Hailstorm in Nebraska (illus.), by H. G. Carter; The R–34 Destroyed in a Gale; and Are the Seasons Changing? by C. J. Root (see p. 16).

No. 2.—Climate of Binghamton, N. Y., Shown by the Histogram Method (illus.), by J. R. Weeks; Temperature Variations in the United States and Elsewhere (illus.), by A. J. Henry (see p. 15); Sequence of Winters in the Northeastern United States (illus.), by C. F. Brooks (see p. 16); A Possible Rainfall Period Equal to One-ninth the Sunspot Period (illus.), by D. Alter; Meteorological Course Given in the Signal Corps School at Camp Alfred Vail, N. J., during 1920, by H. W. Ball; Surface-air and Water Temperatures at Western Bank of Gulf Stream (illus.), by F. G. Tingley; Ocean Rainfall, by H. G. Cornthwaite; Waterspout at San Juan, P. R., by W. C. Haines; The Weather in Finland in 1920—A Warm Year, by L. A. Davis; and Mild Winter of 1920–21 in Northern Europe.

Meteorological observations, 1919, P. Nelson (*Guam Sta. Rpt. 1919, pp. 50–52*).—Observations at the station on temperature, precipitation, humidity, and wind for each month of the year ended June 30, 1919, are summarized in

tables, the data for rainfall being compared with the averages for 14 years. The general meteorological conditions are briefly reviewed. Attention is called especially to the severe typhoon which occurred July 6, 1918, and did great damage in the island.

The atmospheric pressure fell to 28.19 in. on the date of the typhoon, as compared with an average monthly mean of 29.8 in. for July. The highest temperature recorded during the year was 99° F. May 4 and the lowest 69° March 8. A temperature of 90° or over was recorded on 143 days during the year. The annual precipitation was 95.77 in. as compared with a 14-year average of 91.86 in. July was the wettest month with a total of 30.53 in., and April the driest with 0.61 in. The maximum daily precipitation of 10.5 in. occurred July 6, the date of the typhoon.

The weather of Scotland in 1919, A. WATT (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 247–258*).—"This report consists of (1) a general description of the weather over the Scottish area from month to month; (2) a selection of rainfall returns, in which each county in Scotland is represented by one or more stations. . . . The outstanding features of 1919 were the great cold experienced in February, March, and November; the late snowstorm at the very end of April; the almost complete absence of summer thunderstorms in the east; and the prolonged spells of dry weather."

Rainfall distribution in France, A. ANGOT (*Ann. Géogr., 26 (1917), No. 142, pp. 255–272; 28 (1919), No. 151, pp. 1–27; 29 (1920), No. 157, pp. 12–35; 30 (1921), Nos. 163, pp. 32–49; 164, pp. 111–124, pls. 18, figs. 7*).—The available rainfall data are summarized in tables, charts, and diagrams and discussed with reference to monthly and regional distribution. Isohyetal lines are also shown for France as a whole. The average annual rainfall for the country is 832 mm. (32.75 in.), varying from 609 mm. in parts of the north to 1,275 in parts of the southwest. The rainfall is fairly evenly distributed throughout the different months of the year, but averages highest in October, 94 mm., and lowest for February, 53 mm. October is the wettest in almost all regions except certain parts of the southwest and the center where the highest rainfall is in May and June. February is the month of least rainfall in all regions except the Midi, from the Gulf of Gascony to the Alps, where July is the driest month.

Agricultural climatology of Australia, G. TAYLOR (*Quart. Jour. Roy. Met. Soc. [London], 46 (1920), No. 196, pp. 331–356, figs. 9*).—This article deals with the climate, and especially the rainfall, of different regions of Australia, as well as of Tasmania, with particular reference to the controlling influence of rainfall on agricultural production and consequently on settlement. It covers in large measure the same ground as previous articles by the author (E. S. R., 36, p. 209; 40, p. 716). The article also deals briefly with the relation between rainfall and natural vegetation, and especially with the dependence upon the amount and distribution of the rainfall of wheat, oats, sugar production, corn, barley, vineyards and orchards, hay, potatoes, sheep and cattle raising, and dairy farming. Dry farming and the limits of wheat production, the supply of water for irrigation, the occurrence of disastrous droughts, and the sources of artesian water are also discussed. A short bibliography of the subject is added.

SOILS—FERTILIZERS.

The soils and agriculture of the Southern States, H. H. BENNETT (*New York: Macmillan Co., 1921, pp. XVIII+399, pls. 29, figs. 4*).—The author states that this is volume 1 of a series of books which it is hoped will be written to

cover the soils of all sections of the United States and their relation to agriculture. This volume covers those States in the cotton belt south of the northern line of Delaware, Maryland, West Virginia, Kentucky, Missouri, and Kansas. It discusses the principal agricultural districts of the Southern States, their geography and topography, and describes their soils with reference to physical and chemical composition, crop adaptations, and farm management.

Soil survey of Lake County, Ind., T. M. BUSHNELL and W. BARRETT (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 48, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology, deals with the soils of an area of 314,880 acres in the extreme northwestern corner of Indiana. The area includes three main physiographic divisions, namely, the plain of glacial Lake Chicago, the Valparaiso morainic system and associated till plains, and the outwash plain and lake plain of the Kankakee Basin. It is stated that while the drainage conditions in the county have been revolutionized during the past 15 years, a number of places are still too wet for agricultural or other uses.

The soil material of the county consists of glacial deposits, and the present topography of the central part is almost the direct result of glaciation, little modified by erosion. There are also areas of water-laid soils and recent alluvial soils. Including muck, swamp, dunesand, peat, and pits, 30 soil types of 13 series are mapped, of which the Miami, Carrington, and Brookston silt loams cover 15.3, 12.4, and 11 per cent of the area, respectively.

Minnesota glacial soil studies.—I, A comparison of soils on the late Wisconsin and Iowan drifts, C. O. ROST and F. J. ALWAY (*Soil Sci., 11 (1921), No. 3, pp. 161–205, figs. 13*).—Studies conducted by the Minnesota Experiment Station, in which a comparison was made of the composition and properties of the soils on neighboring areas of two drift sheets in southeastern Minnesota, are reported.

These sheets were the Des Moines Lobe of the late Wisconsin and the older glaciation exposed to the east of this, called the Iowan. The original till of these sheets appeared to have been very similar chemically and physically, and the areas compared are so near each other that it is thought they must have been subjected to the same climatic influences since the recession of the last ice sheet. On each drift 15 virgin soils were sampled, 5 samples being taken from each of 3 soil types, namely, Carrington loam, naturally covered with deciduous forest, and Carrington silt loam and Fargo silt loam, both naturally in prairie. The samples were taken to a depth of 3 ft. in four sections—1–6, 7–12, 13–24, and 25–36 in., respectively.

The Carrington loam soil was found to be the coarsest in texture, slightly the highest in silica, and the lowest in alumina. The Fargo silt loam was the finest in texture and the highest in nitrogen, organic carbon, phosphoric acid, magnesia, and lime, while the Carrington silt loam occupied an intermediate position in texture and content of nitrogen and organic carbon. There was no distinct difference as regards potash and soda. An increase in depth was found to be accompanied generally by an increase in coarseness of texture, regularly by a decrease in nitrogen and organic carbon, and less regularly by a decrease in phosphoric acid. In fields where carbonates were encountered they increased with depth, but where they were absent throughout the 3-ft. section the degree of acidity was not distinctly related to the deph. "When comparisons are made on the basis of the carbonate-free, nonvolatile portion of the soil, with increase in depth iron and magnesia are found to increase slightly, noncarbonate lime to decrease slightly, and silica, alumina, and potash to remain practically constant. The leaching effect upon the mineral constituents originally present in the drift has been practically confined to the carbonates."

Comparing the soils from the two drifts, type by type and level by level, no distinct differences were found in texture or content of silica, alumina, potash, soda, magnesia, noncarbonate lime, nitrogen, and organic carbon. The soils on the older drift are considerably richer in phosphoric acid, especially in the upper levels, and contain appreciably more iron and titanium. The carbonates have been so thoroughly leached from the whole 3-ft. section in the forest fields on both drifts that a distinctly acid reaction is found at all levels. The same holds true of the upland prairie on the older drift, but on part of the fields on the younger drift carbonates are found in the third and even in the second foot. A later exploration of the levels below the third foot showed that on both the upland soil types the depth of leaching out of carbonates is in general somewhat greater on the older drift.

"It would appear that the only distinct influence that the greater age of the Iowan drift has been able to exert upon the soils developed upon it is confined to the leaching out of carbonates to a greater depth, and possibly an enrichment of the surface layers in phosphoric acid through the agency of plants. It appears that in a comparison of the chemical composition of the soils on drift sheets neither of which is older than the Iowan the only distinct difference that may justly be attributed to the difference in age is confined to the relative depth of leaching of carbonates. The greater concentration of phosphate near the surface on the older drift, observed in the areas compared in this study, may not be found elsewhere. It appears probable that the marked differences in content of nitrogen and organic carbon reported from comparisons of soils on Wisconsin and Iowan drifts are due to differences in the vegetation and climate that have been associated with the particular portions of the two sheets employed in the comparison. Both the Iowan and Wisconsin glaciations appear to have been too recent to allow sufficient time for any appreciable leaching out of the original content of potash, of noncarbonate lime and magnesia, or of silica, at least in the case of the till or of the finer textured assorted material from this."

A new classification of the soil moisture, G. Bouyoucos (*Soil Sci., 11 (1921), No. 1, pp. 33–47*).—The object of this contribution, from the Michigan Experiment Station, is to prevent a new classification of the soil moisture founded on experimental and scientific principles, and which appears to show the actual condition of the moisture in the soil. This classification is based upon the principle of the freezing of water.

Soil moisture is classified as gravitational, free, and unfree. The unfree soil moisture is subdivided into capillary-adsorbed and combined, and the combined unfree soil moisture is divided into water of solid solution and water of hydration. The free water is that which freezes for the first time at the supercooling of —1.5° C. The capillary-adsorbed water is that which freezes finally at the supercooling of —4° and at the cooling of —78°, minus the free water. The combined water is that which does not freeze at all even at the temperature of —78°.

On the basis of this classification it was found that in some soils only one or two forms of water exist, while in others all three forms exist but in different proportions. The dilatometer method is considered to be capable of measuring the relative amounts of these various forms of water in the soil, the principle of which is based on the fact that water expands upon freezing. The procedure in this method is described. It was found that repeated freezing and thawing causes some of the unfree water to become free, this belonging entirely to the capillary-adsorbed water.

In the light of dilatometer results, together with those of physiological studies, soil moisture is again classified on a physiological basis into gravita-

tional, free, and unfree moisture. The gravitational water is classified as superavailable and the free water is very available. Of the unfree water the capillary-adsorbed water is classified as only slightly available and the combined water as unavailable. It is also thought that the dilatometer method is capable of determining the wilting coefficient of soils more accurately and definitely than by the means of the plant.

The movement of soil moisture, W. GARDNER and J. A. WIDTSOE (*Soil Sci., 11 (1921), No. 3, pp. 215–232, figs. 11*).—In a contribution from the Utah Experiment Station, a general equation for the movement of moisture through an ideal soil is developed. Two assumptions were made in the development and integration of this equation, namely, (1) the inherent moisture conductivity in an ideal soil is independent of the moisture content, and (2) the capillary potential is a linear function of the reciprocal of the moisture content. The general equation was solved for various special cases, and experimental results obtained from ordinary soils are said to support the general theory. The results are not considered wholly conclusive, however. "Departures from the general equation and its integrated forms that may arise in future investigations may be traced to one or the other of the two assumptions named."

The prevention of soil erosion.—V, The use of concrete, M. H. HOFFMAN and A. W. TURNER (*Iowa Agr. Col. Ext. Bul. 80 (1921), pp. 8, figs. 10*).—In this number of this series (E. S. R., 44, p. 316), the use of solid dams of concrete or masonry for checking erosion is described and diagrammatically illustrated. It is pointed out that a dam should be built with a footing several feet below the bottom of the ditch on a firm foundation with its ends well out into the bank, the middle considerably lower than the ends, and with a downstream curvature of about 120°. The importance of concrete boxes for road culverts where permissible is also recommended.

A pitless lysimeter equipment, W. H. MACINTIRE and C. A. MOOERS (*Soil Sci., 11 (1921), No. 3, pp. 207–213, figs. 5*).—A lysimeter equipment at the Tennessee Experiment Station is described and illustrated, which is considered distinctive in that no surface or subsurface concrete enclosure is required.

Chemical effect of salts on soils, W. P. KELLEY and A. B. CUMMINS (*Soil Sci., 11 (1921), No. 2, pp. 139–159, figs. 7*).—Experiments conducted at the Citrus Experiment Station of the University of California on the influence of salts on light sandy loam and clay loam soils showed that chemically equivalent solutions of the chlorids, sulphates, and nitrates in a given base produced substantially equivalent chemical reactions in the soils.

The solubility of the anion of the neutral salt solutions was not materially affected by the soils studied, but an exchange of bases took place with the result that a portion of the base of the added salt passed out of solution and a chemically equivalent amount of other bases was set free from the soil silicates. With reference to the extent to which the simple salts produce these reactions, the bases stood in the following ascending order: Calcium, sodium, ammonium, potassium, and magnesium. Calcium was the most readily replaced from these soils, but the solubility of magnesium and potassium also was increased to some extent. It was not certain that significant amounts of sodium were set free by any of the salts used.

Considerable amounts of phosphoric acid were precipitated by each of these soils. Chemical reactions took place between soils and alkaline solutions which resulted in the conversion of normal carbonate into bicarbonate, a material lowering of the OH-ion concentration of the solution, and the precipitation of greater amounts of the cation of the solution than takes place with neutral solutions. The reactions between neutral salts and soils are considered to be

dependent on the concentration and apparently obey the principle of mass action. Evidence was obtained that the reactions are reversible.

It is suggested that the continued addition of soluble salts in the open field, where the products of the reactions are removed by either the growth of crops or intermittent leaching, must ultimately result in building up a chemical system different from that originally present.

Some studies on the rate of formation of soluble substances in several organic soils, M. M. McCool and L. C. Wheeting (*Soil Sci., 11 (1921), No. 3, pp. 233–247, figs. 4*).—The results of a preliminary study conducted at the Michigan Experiment Station on the relative powers of seven organic soils to form soluble substances at different temperatures under different moisture conditions and at different depths under optimum moisture conditions are reported.

The freezing-point method for the determination of soluble material in the soil solution was used as the means of studying the changes in concentration. It was found that at any given moisture content the effect of a higher temperature is to increase the rate of formation of soluble material, and conversely that lower temperatures decrease the rate of formation. For the higher temperatures, optimum moisture conditions tend to bring greater amounts of material into solution than are found under saturated water conditions. Exactly the opposite effect was observed with lower temperatures.

In general, moist soils upon standing were found to increase in concentration to a certain point, after which a decline occurred. This is considered to be probably due to reabsorption, chemical change to less soluble compounds, or biological activity. Organic soils varied at different depths in the amount of soluble substances present. Different depths also varied in the rate and amount of material made soluble upon standing. Below a depth of 2 ft. the muck soils studied were very inactive. The surface layers were found to usually produce the bulk of the soluble plant foods. As a rule, the ability to yield soluble materials decreased regularly from the surface to the water table. The zone of weathering and the region of greatest activity were found to coincide closely.

The relation of the phosphoric acid of the soil to pot experiments, G. S. Fraps (*Texas Sta. Bul. 267 (1920), pp. 5–53, figs. 2*).—This bulletin deals with the relation between the chemical composition of 95 samples of soils and the results of pot experiments.

The average total weights of four crops grown during two years on soils which received potash and nitrogen but no phosphoric acid increased with the active phosphoric acid of the soil, with the exception of one series. The same conclusion was reached when considering the first crop alone, the first and second crops combined, the first three crops combined, the fourth crop alone, all four crops combined, or the phosphoric acid removed by the various crops. Variation was noted in the amount of phosphoric acid removed or the size of crop grown on different soils containing the same amounts of active phosphoric acid. The total and ignition-soluble phosphoric acid, phosphoric acid soluble in cold 10 per cent hydrochloric acid, active phosphoric acid dissolved by five successive extractions, active potash, lime, acidity, surface or subsoil, and acid consumed were taken into consideration in an attempt to ascertain the causes of these variations.

It was found that there is a tendency for soils containing total phosphoric acid or total nitrogen higher than the average to give higher yields of phosphoric acid to crops than soils with the same quantities of active phosphoric acid but containing the average amounts of total phosphoric acid and nitrogen. Surface soils containing the same amounts of active phosphoric acid on an average gave

up more phosphoric acid to crops than subsoils containing corresponding amounts of active phosphoric acid. Exceptions to this relation are noted. There was some tendency for soils containing the same amounts of active phosphoric acid to give up more phosphoric acid to crops as the total phosphoric acid increased, but this difference was not clearly marked. There seemed to be a slight tendency for soils containing equal amounts of active phosphoric acid to give up more phosphoric acid to crops if they contained more nitrogen, which usually meant that they contained more organic matter. Soils with the same content of active phosphoric acid and which were not acid on an average gave up more phosphoric acid and produced larger crops than acid soils. Exceptions to this relation are also noted.

No relations could be observed when soils containing the same amounts of active phosphoric acid were arranged in groups according to the acid consumed, which indicated the amounts of bases present. When the soils were arranged in groups according to the phosphoric acid withdrawn by crops in the pot experiments, there was a better relation between the active phosphoric acid and the crop production than any other character.

Statistical methods showed that there was a better relation between the active phosphoric acid and the phosphoric acid removed by four crops than between the total phosphoric acid in the soil and the phosphoric acid removed by four crops. The correlation coefficient for the active phosphoric acid was 0.57 and for the total phosphoric acid 0.45. There did not seem to be any relation between the active phosphoric acid extracted by five extractions and the relative production in groups arranged according to the active phosphoric acid taken from the soil by groups.

The presence of lime rendered the interpretation of the analyses more difficult, since sometimes it was accompanied by a higher and sometimes by a lower utilization of phosphoric acid in soils of corresponding active phosphoric acid content.

Soils, G. Briggs (*Guam Sta. Rpt. 1919, pp. 35–37*).—Pot and field experiments to compare the productiveness of old and newly broken soils and to study their fertilizer requirements showed that while there was scarcely any difference in the chemical analyses of these soils the old soil gave the largest yields of corn, kafir, cotton, cowpeas, radishes, peppers, and rice. The second crop showed smaller differences than the first, indicating that the new soils increased in productivity.

Commercial fertilizers and fertilizers of local origin, including barnyard manure, lime, green manure, coconut husk ash, sea slugs, seaweeds, and bat guano were tested in pot experiments, indicating that certain of the local products gave equally as good results as some of the commercial fertilizers. Manure was very beneficial to both old and new soils. Lime on the old soil and bat guano on the new soil produced a good growth of corn, while seaweeds, coconut husk ash, and certain combinations of commercial fertilizers containing acid phosphate were noticeable in their beneficial effects.

Vegetation experiments with different potash fertilizer salts and on phosphoric acid and lime fertilization, E. A. Mitscherlich, S. von Saucken, and F. Iffland (*Landw. Jahrb., 53 (1919), pp. 501–514, pls. 4*).—Pot experiments with potassium chlorid on sand with oats are reported, which showed that the best results were obtained when the ratio of potash to nitrogen used was 1:4. No injurious influence of potassium chlorid was evident either with an excess or a minimum application of nitrogen.

In experiments with the sulphate, nitrate, and carbonate of potassium and primary and secondary potassium phosphates, the highest yields of oats were

obtained with the maximum applications of all the fertilizers, but this was not true with potassium chlorid. The relative values of the different salts varied widely. The potassium carbonate gave the best results, followed in order by the potassium sulphate and potassium nitrate.

Experiments with oats on the influence of lime on the activity of the phosphoric acid in tricalcium phosphate, Thomas meal, and Anguar phosphate showed that gypsum apparently had no effect, while calcium nitrate strikingly decreased the activity of the phosphoric acid. Thomas meal was affected less than the other phosphates. With carrots, oats, and peas, the three phosphates produced results with all three crops in the ratio of 1 : 0.47 : 0.1.

When dicalcium and tricalcium phosphates were applied to oats to determine the influence of watering with tap and distilled waters, the total yield was always greater with tap water, but the difference was small. However, with tap water the grain yield was about 50 per cent of the total yield and with distilled water only about 33 per cent.

Keeping soils productive, R. R. Hudelson (*Missouri Sta. Circ. 102 (1921), pp. 24, figs. 8*).—Popular information for the use of farmers on maintaining the fertility and producticity of Missouri soils, based on the summarized results of work at the station, is given.

Data on the composition and loss of plant nutrients from these soils are summarized, indicating that many of them are distinctly deficient in nitrogen and phosphorus. Potassium is abundant in most soils although frequently insoluble, and it is considered advisable to increase the availability of soil potash by proper treatment rather than by actual additions.

Information is given on the use of green and stable manures and crop residues, and on the growing of legumes, and it is stated that both acid phosphate and bone meal have given excellent results on nearly all these soils. Raw rock phosphate has not given as satisfactory returns on these soils as steamed bone meal or acid phosphate, and when used it should be purchased under a guaranty that at least 90 per cent will pass through a 100-mesh sieve. One of the most urgent soil problems of Missouri is said to be that of maintaining a supply of lime.

Information is also given on the selection and use of commercial fertilizers.

Fertilizers and manures, A. D. Hall (*New York: E. P. Dutton & Co., 1920, pp. XVI+384, pls. 7*).—This book is intended to supplement a previous one on The Soil (E. S. R., 43, p. 621), and is written in nontechnical language for farmers and students. Its purpose is to give practical information on the use of fertilizers and manures. A great deal of the information presented is based on the results of work at the Rothamsted Experimental Station. Chapters are included on fertilizers containing nitrogen, the function and comparative value of nitrogenous manures, phosphatic manures, the function and use of phosphatic fertilizers, the potassic fertilizers, farmyard manure, Peruvian guano and other mixed fertilizers, materials of indirect fertilizing value, theories of fertilizer action, systems of manuring crops, the valuation and purchase of fertilizers, and the conduct of experiments with fertilizers.

Phosphate rock in 1919, R. W. Stone (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. [2]+211–225*).—This bulletin reports data on the production and export of phosphate rock in 1919 and on foreign phosphate deposits.

It is stated that the phosphate rock sold in the United States in 1919 amounted to 2,271,983 long tons, valued at $11,591,268. As compared with the production in 1918, this was a decrease in quantity of 9 per cent and an increase in value of approximately 41 per cent. The total quantity of phosphate rock mined in 1919 was 1,851,549 long tons, a decrease of nearly 19 per cent from the output in 1918.

Stocks reported on hand at the end of 1919 were about 555,000 long tons, or a decrease of about 50 per cent from 1918. In 1919 there was an increase in quantity of phosphate rock sold in South Carolina, Tennessee, Idaho, and Utah, and an increase in value in all the producing States except Kentucky. The quantity of phosphate rock exported from the United States in 1919 was 378,731 long tons.

The storage and handling of potash, G. F. Zimmer (*Chem. Age [London], 4 (1921), No. 82, pp. 34–37, figs. 7*).—Methods and machinery for the storage and handling of potash salts in large amounts are described and illustrated.

Lime: Definitions and specifications (*U. S. Dept. Com., Bur. Standards Circ. 106 (1920), pp. 15*).—Definitions of the generally used terms relating to compounds of calcium are given, with particular reference to agricultural limes.

The transformation of caustic lime in soil and the solubility of the lime compounds formed in their relation to the theory of lime action, G. Hager (*Jour. Landw., 65 (1917), pp. 245–311, fig. 1*).—Extensive studies conducted at the University of Göttingen are reported which failed to confirm the assumption that burnt lime changes completely into calcium carbonate in a short time in soil. Only a part of the lime combined with carbon dioxid, the remainder being adsorbed by the soil particles and leaving no free calcium hydroxid in the soil after a short time. The alkaline reaction of limed soil is attributed, in addition to calcium carbonate, to the calcium hydroxid separated again from the soil particles in small quantities by the action of water. It was not determined whether the lime adsorption was due to surface action or chemical causes or both.

Liming increased the adsorptive power of soils for other bases, such as potash and ammonia. The higher the content of fine particles in soil and the less adsorptively saturated it was, the greater were the amounts of lime fixed by the soil constituents. That part of the lime combining with carbon dioxid increased as the amounts of lime added increased. Generally, an equilibrium between the combining power of carbon dioxid in soil and the adsorbing power of soil was reached in a short time.

Calcium carbonate was transformed more slowly in soil than burnt lime. Caustic lime is therefore considered to be adapted for use on adsorptively unsaturated soils. Lime combined with carbon dioxid and with soil constituents was dissolved out by soil water containing carbon dioxid. It was also leached out in both combinations. The compounds formed by caustic lime in soil were not dissolved as rapidly by water containing carbon dioxid as artifically prepared aragonite.

It is the author's opinion that the greater activity of burnt lime in soil can not be attributed wholly to greater solubiltiy of its combinations with soil. More probably the lime adsorbed by soil constituents stands in some relation to the soil crumb structure. This point needs further study.

In dry soil rich in fine particles, such as loam and clay soils, enough water remains to slake caustic lime, resulting in a lime solution which can not be duplicated by the action of calcium carbonate and water containing carbon dioxid. Adsorption results in an energetic crumb formation, which eventually causes a change in the physical structure of the soil.

Sulphur and sulphur composts in relation to plant nutrition, W. E. Tottingham and E. B. Hart (*Soil Sci., 11 (1921), No. 1, pp. 49–73, figs. 6*).—In a contribution from the University of Wisconsin, experiments are reported on the application of the procedure of composting floats with manure or soil. A silt loam soil and a garden soil, prepared by composting silt loam with manure, leaf mold, and sod, were used.

It was found that soil composts with sulphur added developed much acidity in 32 weeks, which was greater where sulphur was used alone than where rock phosphate also was added. Dissociated acid formed but a small portion of the total acid. Composts of sulphur with horse manure showed appreciable increases in acidity but no increase in citrate-soluble phosphoric acid after 15 weeks.

Sulphur decreased the loss of organic matter in manure by fermentation. Increased bacterial counts in these composts were maintained to the conclusion of 12.5 weeks. Acidity doubled in the rock phosphate and sulphur compost over this period, but was unchanged after 4.5 weeks. The variations of water-soluble sulphate were in the same direction as those of acidity, increasing where sulphur was added and decreasing in the other cases. Citrate-soluble phosphoric acid approximately doubled where sulphur was added, the percentage being based upon the common basis of original dry matter of the composts. In the other cases the percentage of this constituent decreased approximately one-half.

Yields of oats from soil cultures to which these composts were applied agreed generally with the results of analysis of the latter, producing the greatest yields where sulphur had been applied. On sandy loam the yield of seed where sulphur compost was applied was as great as where the corresponding treatment included rock phosphate. Increased yields of oats were obtained also from the application of rock phosphate and sulphur with fermented manure.

Similar composts which fermented 18.5 weeks showed 60 per cent greater availability of phosphoric acid (solubility in ammonium-citrate solution) by the addition of sulphur to rock phosphate. When aerated by weekly mixing the corresponding increase of available phosphoric acid was 90 per cent, although the total acidity was decreased thereby. The total acidity developed in the complete compost was nearly as great as that resulting from an equivalent addition of acid phosphate to the fermented manure. In this experiment the use of sulphur alone did not increase the proportion of citrate-soluble phosphoric acid in the manure. Application of these fermented manures and composts to sand cultures of barley led to equal yields from the rock phosphate and sulphur compost and a corresponding portion of fermented manure supplemented by acid phosphate. These yields were not superior to those from sulphur compost and manure reinforced by rock phosphate and sulphur.

The process of sulfofication was inactive after 12 weeks, but became very active after 18 weeks.

In greenhouse trials on silt loam and sandy loam with clover and Cruciferae, sulphur increased growth on the former soil, 100 lbs. per acre being as effective as more. Barley on field plats of sandy silt loam apparently in need of lime produced increased yields of seed by the application of sulphur. Sulphur alone was as effective as its combinations with marl and rock phosphate, and 100 lbs. of sulphur per acre was as effective as 50 or 300 lbs. Calcium sulphate produced better yields of oats upon silt loam than equivalent amounts of sodium sulphate or sulphur when these supplemented the usual complete fertilizer in greenhouse cultures. Liming depressed the efficiency of calcium sulphate under these conditions, and 100 lbs. of elemental sulphur was more effective than either one-third or three times as much. Benefits from elemental sulphur were not apparent when it was superimposed upon the sulphates for application.

"It appears probable that sulphur functions as a fertilizer both by oxidation to the nutrient SO_3 and by producing, through oxidation, an acid condition favorable to the production of available P_2O_5. These processes occur in composts of sulphur and rock phosphate. They also, doubtless, continue when the

compost materials are tilled into the soil. It remains to be proved whether the efficiency of sulphur is any greater when it is composted with rock phosphates and manure than when these materials are added simultaneously to the soil. Adequate consideration of the use of sulphur as a fertilizer must recognize its tendency to deplete the stock of CaO, P_2O_5, and other soil constituents."

Inoculated sulphur as a plant-food solvent, J. G. LIPMAN, A. W. BLAIR, W. H. MARTIN, and C. S. BECKWITH (*Soil Sci., 11 (1921), No. 2, pp. 87–92*).—Experiments conducted by the New Jersey Experiment Stations are reported, showing that inoculated sulphur is apparently more effective than uninoculated sulphur for rendering inert mineral plant food available to growing crops. Mixtures of inoculated sulphur and ground phosphate rock gave better results than phosphate rock alone.

Commercial fertilizers, 1919–20, W. H. DORE (*California Sta. Bul. 327 (1920), pp. 93–127*).—This bulletin contains the results of actual and guarantied analyses and valuations of 365 samples of fertilizers and fertilizer materials collected for inspection in California during the fiscal year ended June 30, 1920, together with a list of registered manufacturers and dealers. Of the total number of valuations reported, 64 per cent were above the amount guarantied and 36 per cent below. There were 26 deficiencies in available phosphoric acid, 56 in total nitrogen, 4 in potash, and 43 in valuation.

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures, 1920, C. S. CATHCART ET AL. (*New Jersey Stas. Bul. 344 (1920), pp. 5–47*).—This bulletin contains actual and guarantied analyses of 566 samples of fertilizers and fertilizer materials collected for inspection in New Jersey during the spring of 1920. These included 86 brands of fertilizer materials, 7 home mixtures, 339 brands of commercial fertilizers containing nitrogen, phosphoric acid, and potash, 122 brands containing nitrogen and phosphoric acid, and 12 duplicates.

Commercial fertilizers in 1919–20, G. S. FRAPS and S. E. ASBURY (*Texas Sta. Bul. 265 (1920), pp. 3–25*).—This bulletin contains the results of actual and guarantied analyses and valuations of 420 fertilizers and fertilizer materials collected for inspection in Texas during the year ended September 1, 1920, together with a list of brands registered for sale in the State during the year.

AGRICULTURAL BOTANY.

Normal and abnormal germination of grass fruits, J. ZINN (*Mitt. Landw. Lehrkanz. K. K. Hochsch. Bodenkul. Wien, 2 (1914), No. 4, pp. 675–712, pls. 8; abs. in Maine Sta. Bul. 294 (1920), pp. 195–216, pls. 4*).—A description is given of the processes that take place at the time of emergence of the radicle of hulled grass fruits from the surrounding tissues.

The penetration of the germinating embryo through the tissues of the adhering pericarp is said to be a purely mechanical process. In normal germination the coleorhiza breaks through the base of the fertile glume within a zone whose mechanical resistance is greatly lessened by the reduction and differentiation of the epidermal and hypodermal cells. The prosenchymatous tissue yields along lines of contact of the long schlerenchymatous cells. Likewise, the epidermis is ruptured in a region where cells marked by different morphological forms and physical structure meet. In both cases the cells are pushed apart.

The abnormal germination of hulled grass fruits is said to be caused by external mechanical factors which so operate as to thwart and eliminate the growth tendency of the radicle in the normal direction.

The chief function of the coleorhiza is said to be its mechanical performance in breaking through the tissues of the glume, and its further function as a protective organ for the tender radicle. The radicle emerges from the coleorhiza through a longitudinal opening formed by the cells being detached and pushed apart without being injured in any way.

Abnormal conditions in [planting] seed, M. HOLLRUNG (*Kühn Arch., 8 (1919), pp. 352*).—This is a systematic account of conditions related to germinability in seeds, including after-ripening, rest period, germination, and different forms of seed treatments as applied to cereals, beets, potatoes, legumes, and other plants.

Antagonistic reactions and rôle of the callus in grafted plants, L. DANIEL (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 25, pp. 1512–1515*).—The author concludes from his studies that the callus contributes in a considerable part to modify the biological state of both stock and graft and to determine a clearly marked antagonism, giving rise to the formation of reparatory organs. These are discussed as to their function and probable significance.

Immunity of annual plants to symbiotic fungi, J. MAGROU (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 10, pp. 616–618*).—A study of several plants along lines suggested in work previously noted (E. S. R., 30 p. 730) is considered to justify the view that symbiosis depends upon the conditions of resistance by the mycelial body to something similar to phagocytosis in the higher plants. Immunity is correlated with the destruction of that mycelium.

The necessity of vitamins to the development of plants, A. LUMIÈRE (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 4, pp. 271–273*).—Studies cited with discussion are considered to show that vitamins are substances indispensable to life, being incapable of replacement by any chemical substance.

Influence of the carbon source upon the utilization of nitrogen by Bacillus subtilis, E. AUBEL (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 9, pp. 478–480*).—It is claimed, on the basis of the data here presented, that under these conditions the nature of the carbon source exercises a distinct influence on the utilization of nitrogen by *B. subtilis*. An increased yield was associated with glycerin over that with levulose, which was in turn greater than that with glucose.

Influence of small amounts of potassium on physiological characters of Sterigmatocystis nigra, M. MOLLIARD (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 16, pp. 949–951*).—A study of *S. nigra* growing in a nutritive medium containing a small amount of KH_2PO_4 shows a marked specific action on the development of the fungus in ways which are detailed.

The action of chlorin and other vapors on plants, P. GUÉRIN and C. LORMAND (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 7, pp. 401–403*).—Experimentation testing the effects of several military gases on different plants showed that exposure for one to two hours to an atmosphere containing small quantities of chlorin, palite, bromacetone, chloropicrin, and mustard gas caused temporary loss of leaves without any apparent permanent injury to the plant itself. The effect on the leaves appears to be due to marked plasmolysis or protoplasmic contraction produced. In cherry laurel subjected to chlorin the change is followed by disengagement of hydrocyanic acid, and in *Aucuba japonica* by very intense blackening of the leaves.

Action of chloropicrin on higher plants, G. BERTRAND (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 14, pp. 858–860*).—The author adds to the above report an account of studies by himself on the effects of chloropicrin as noted in connection with such plants as pear, elm, poplar, lilac, grape, cherry laurel, and spindle tree. These plants or portions thereof were subjected to chloropicrin under varying conditions. The results are detailed with discussion.

Plasmolytic effect of vapors, P. Guérin and C. Lormand (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 26, pp. 1598–1601*).—The authors have been able in the course of the study here reported (as a continuation of those above noted) to confirm most of the conclusions previously announced by Mirande (E. S. R., 24, p. 139). Details are added regarding the effects of different poisons on plants.

Anthracene as a tar constituent injurious to plants, R. Ewert (*Jahresber. Ver. Angew. Bot., 15* (*1917*), *No. 2, pp. 170–172*).—The author concludes as a result of studies indicated that anthracene itself is the most injurious of its group to plants, causing a characteristic form of injury.

Action of hydrocyanic acid [on seeds and on parasitic organisms], J. Stoklasa (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 23, pp. 1404–1407*).—Tests applied to seeds of economic plants indicate that hydrocyanic acid as here uesd is an excellent disinfectant for seeds, increasing development and yield.

Comparative study of microflora and nitrogen content of soils partially sterilized with calcium sulphid, G. Truffaut and N. Bezssonoff (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 4, pp. 268–271*).—In three series of experiments employing considerable quantities of sulphid and carbid in connection with cultures of wheat, endive, and turnip in porous pots giving constant aeration, the porous medium was found to favor (though decreasingly with the lapse of time) the loss of ammoniacal nitrogen by diffusion, but to hinder the continued development of anaerobic bacteria, such as *Bacillus butyricus.*

Under conditions of culture in the open field, using 150 kg. calcium sulphid per hectare (133.5 lbs. per acre), the soil did not become poor in nitrogen despite a considerable removal of that element.

Absorption of calcium by plant roots and its antitoxic properties toward copper, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 8, pp. 420–425*).—Having noted in a previous communication (E. S. R., 39, p. 526) a preponderant and specific action of calcium on the development of growing plants, the author set out to investigate the relation between this effect and the neutralizing effects of calcium on copper compounds, which are ordinarily injurious when used alone.

It is found by repeated tests that calcium, even in excess, does not oppose either the absorption of copper by the roots or its diffusion in the aerial portions. The presence of copper does not hinder the assimilation of calcium. The action of calcium in connection with copper appears to be physiological. It favors the diffusion of the latter, probably preventing, within limits, its undue accumulation at any point.

A case of favorable action of copper on vegetation, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 26, pp. 1542–1545*).—Having found in work previously noted (E. S. R., 44, p. 825) that copper is widely distributed in the tissues of plants, the authors have carried out studies in sterile media with peas, lettuce, and wheat. While the experimentation noted is not regarded as establishing an alimentary value for copper, it is regarded as proving that in certain media and under certain conditions copper exerts an antitoxic function, as does calcium in connection with certain other metals throughout a wide range of conditions.

Iron as toxic [to plants] and copper as antitoxic, L. Maquenne and E. Demoussy (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 4, pp. 218–222*).—Data presented, showing the antagonistic effects of copper and the injurious effects of iron on plant roots, suggest several practical applications.

[Osmosis in plant physiology], P. Lesage (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 6, pp. 358–360*).—Having employed acetocellulose as an osmotic membrane in the repetition of experimentation by others on osmosis and as-

piration due to evaporation, the author discusses the data and offers suggestions regarding their scientific and practical bearings.

Studies on the evolution of protoplasm in plants, V. GALIPPE (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 6, pp. 342–345*).—Culture studies briefly noted as applying to cells from the floral epidermis of Iris, tulip, and other plants are said to show that the living part of the protoplasm is constituted by microzymes.

Cytoplasmic elements, A. GUILLIERMOND (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 10, pp. 612–615, figs. 5*).—The author describes the chondriomes in contrast with other and somewhat similar bodies observable in the cell, in particular as regards their reactions to stains. Vegetable cells are said to show, in addition to globules presumably lipoid in character (having nothing in common with chondriosomes), a vacuolar apparatus called the vacuome by Dangeard (E. S. R., 44, p. 822), showing mitochondrial forms, and chondriomes similar to those of animals, and represented by two varieties of mitochondria.

Structure and metabolism of vegetable cells, P. A. DANGEARD (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 12, pp. 709–714*).—The author discusses his own views regarding three cell constituents as previously noted (E. S. R., 44, p. 822), with critical notes on the conclusions of Guilliermond, noted above.

The structure of plant cells, A. GUILLIERMOND (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 25, pp. 1515–1518*).—A reply to the article noted above.

Vacuome, plastidome, and spherome in Asparagus, P. A. DANGEARD (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 2, pp. 69–74, figs. 16*).—The author utilizes the terms previously introduced by himself (E. S. R., 44, p. 822), in describing cellular constitution in *A. verticillatus*, which was studied in this connection. The characters of three constituents named are separately detailed, and the changes undergone are briefly noted.

Cytological study of the sexual organs of ferns, L. EMBERGER (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 16, pp. 735–737*).—The author reports that the sexual organs of ferns show clearly in certain stages the existence in cells of the chrondriome composed of two varieties of mitochondria, which preserve their individuality throughout their development. One form represents the mitochondria destined to develop as plastids, the other mitochondria unknown as to function.

The evolution of chondriome and of plastids in the Fucaceae, G. MANGENOT (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 3, pp. 200, 201, fig. 1*).—From the same point of view as that held in the previous communication (E. S. R., 44, p. 823), the author now deals with the reproductive organs of Fucus.

It is stated that the evolution of the chondriome and of plastids in the Fucaceae is associated with the persistence of phaeoplasts throughout the whole developmental period of the plant. However, the phaeoplasts of young tissues and of reproductive organs are minute in size and very sensitive to chemical agents, differing clearly from the larger phaeoplasts occurring in the peripheral cells.

It is stated that there exists along with these plastids, in all of the cells, a chondriome made up exclusively of granular mitochondria, the functions of which remain unknown.

Evolution of the chondriome in vascular cryptogams, L. EMBERGER (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 5, pp. 282–284, figs. 5*).—Observations cited are said to show the existence of two distinct varieties of mitochondria in the root meristem of *Athyrium filix-femina*. These varieties show practically the same forms, but differ somewhat in size and in intensity

of coloration. Of these varieties, the more numerous comprises young plastids; the other, mitochondria of unknown significance as regards their functions.

Evolution of the chondriome in the formation of the sporangium of ferns, L. EMBERGER (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 8, pp. 469–471, figs. 7*).—Study of *Scolopendrium vulgare* and *Asplenium ruta-muraria* from the evolutionary point of view, as indicated in the study noted above, shows in all stages of development of the cell the two varieties of mitochondria previously mentioned. Evidence of mitochondrial reversibility is apparent in the cell changes involved in the development of the sporangium.

Evolution of the chondriome during the formation of pollen grains, A. GUILLIERMOND (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 17, pp. 1003–1006, figs. 11*).—A study of the appearance of the chondriomes during the formation of pollen grains of *Lilium candidum* is briefly detailed.

Observations on chondriomes in living cells, A. GUILLIERMOND (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 22, pp. 1329–1331, figs. 5*).—A study of cellular elements in *Saprolegnia* sp. is discussed, including the technique and results of employment of different colorants.

The chondriome in Vaucheria, G. MANGENOT (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 24, pp. 1458, 1459*).—Three sorts of granulations are briefly indicated as distinguishable in Vaucheria. The evolution of the chondriome in plants is held to prove that chloroplasts should be considered as mitochondria adapted to chlorophyll assimilation.

Period required for the development of chlorophyll in maximum light intensity, H. COUPIN (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 12, pp. 753, 754*).—Studies continuing those previously noted (E. S. R., 44, p. 824) on several garden and other plants show that the time required to obtain maximum green coloration in leaves or cotyledons varies from 1 to 5 days, that required for other portions being 3 to 15 days. In no case was maximum coloration obtained in less than one full day of sunshine.

Action of radiations of different wave lengths on chlorophyll, R. WURMSER (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 26, pp. 1610–1612*).—Details are given in tabular form with discussion for the red, green, and violet portion of the spectrum regarding absorbed energy, velocity of reaction, ratios between these two, constant of absorption, and photochemical sensitivity observed in the study of chlorophyll prepared according to the method of Willstatter and Stoll.

Action of light waves of different lengths on chlorophyll assimilation, R. WURMSER (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 17, pp. 820–822*).—Having followed the changes in alkalinity of sea water containing algae (*Rhodymenia palmata* and *Ulva lactuca*) exposed to light waves of different lengths, the author reports having demonstrated the existence of two maxima. The red pigment of algae is associated with assimilation occurring at low intensities as regards luminosity.

Resistance of plants to starvation, H. COUPIN (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 12, pp. 550, 551*).—Higher plants deprived of light showed exhaustion after periods ranging from 15 days for Provence alfalfa to 60 days for pignon pine (*Pinus pinea*).

Phenomena of torsion comparable to the twisting of tendrils produced experimentally, H. RICOME (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 23, pp. 1399–1401*).—It is stated that torsions comparable to twisting of tendrils may be produced by geotropism in a plant, and that heliotropism may be employed to give a similar effect.

Orientation of branches in space, H. RICOME (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 16, pp. 734, 735*).—The author holds that the orientation

of branches, under the influence of gravity, depends upon the content of water at disposal to allow for the effects of its unequal distribution as determining weight.

The transmission of fasciation and of dichotomy, J. D. D'Oliveira (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 10, pp. 615, 616*).—The alleged transmission, by grape stock to graft, of the two specific characters fasciation and dichotomy is recorded with discussion.

Production by traumatism of a new form of maize having multiple caryopses, L. Blaringhem (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 11, pp. 677–679*).—Out of one of the groups derived from a culture of *Zea mays* separated about 1903, after wounding the principal stem (E. S. R., 18, p. 732; 19, p. 1128), the author isolated a strain having crinkled leaves, also the line designated as *Z. mays polysperma*, having two or three caryopses intimately fused together. He gives a brief account of how he obtained, among the strains arising from seed developing in a terminal inflorescence (fasciated) a new form of maize showing heredity of that character. This is considered a typical example of inheritance of acquired characters.

[Peloria], L. Blaringhem (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 4, pp. 252–254*).—A study of the nature and heredity of peloria in *Digitalis purpurea* concludes with a claim that this is a case of hereditary fasciation. Partial sterility also appears as a feature of the case in question.

FIELD CROPS.

Forage crops in western Kansas, R. E. Getty (*Kansas Sta. Bul. 225* (*1921*), *pp. 3–54, figs. 10*).—Cultural and field practices applicable to the production of forage crops in the western half of Kansas are described. The information presented in this publication was derived from variety and cultural experiments conducted at the Fort Hays Substation in cooperation with the Office of Forage Crop Investigations of the U. S. Department of Agriculture from 1913 to 1919, inclusive. Data on environmental conditions and experimental results are tabulated and discussed, together with notes on insects and rodent pests.

Sorghums have proved most productive, particularly in dry seasons, with the heaviest forage yields given by the sweet sorghums (sorgos). Red Amber sorgo in a 6-year test gave an average acre yield of 3.45 tons of cured fodder, while corn produced only 1.52 tons. Red Amber made 3.57 tons of hay per acre, while German millet yielded 61 per cent and Sudan grass 76 per cent as much. Sumac, Orange, Western Orange, and improved Black Amber are also valuable sorgos, but seldom equal to Red Amber.

For both grain and forage, Pink, Sunrise, and Dawn kafirs are recommended as the best varieties; for grain alone, feterita, milo, and Freed are better adapted, especially under adverse conditions.

Between May 15 and June 15 is usually the best time to plant sorghums for grain and forage, but early varieties may be planted for forage up to July 1. Varying the rates of seeding affected forage yields but little when the land was well occupied. For hay, close drilling sorgo at the rate of 30 to 40 lbs. per acre has been found to be a good practice in favorable seasons. Spacing sorghum plants 4 to 8 in. apart in the row for forage, and 8 to 12 in. apart for grain in rows 3 to 3.5 ft. apart, are recommended for best results. Analyses of Red Amber sorghum hay, cut at four stages of maturity, are reported.

The culture of Sudan grass for hay and pasture is advised in the place of much of the millet now grown. Seeding between May 15 and June 15 is held best, but good yields have been obtained at Fort Hays when planted as early

as May 1 and as late as July 15. For hay, Sudan grass should be seeded at the rate of 15 to 20 lbs. per acre in close drills, or 3 to 4 lbs. per acre in rows 3.5 ft. apart, and cut between the first head and the full-bloom stage. Although an uncertain seed crop, profitable yields are sometimes obtained. For seed, the crop should be planted in rows. Analyses of Sudan grass hay, cut at different stages, are reported.

German or Golden millet yields the most hay, but earlier varieties such as Kursk, Siberian, common, Hungarian, and Goldmine are more drought resistant. Grasses failed to give good results when seeded for permanent hay or pasture. Although once considered promising, brome grass is unsuited for land too dry for alfalfa.

Alfalfa is the most desirable forage crop to grow on irrigated land or on unirrigated bottom land, but is rarely profitable on dry uplands with an annual rainfall of 25 in. or less. Common alfalfa is preferred to other varieties. Biennial white sweet clover is suggested for pasture on bottom lands too sandy or too close to ground water for alfalfa, but is not recommended for upland conditions. Drilling from 10 to 15 lbs. per acre from April 15 to May 15 is considered the best practice in obtaining stands of alfalfa and sweet clover. Analyses of sweet clover and alfalfa leaves and stems are reported.

Results with the annual legume crops, including field peas, cowpeas, soy beans, tepary, and pinto beans, vetch, chick-peas, and Spanish peanuts, do not warrant their general planting.

Sunflowers, sugar beets, mangel-wurzels, turnips, rape, Tunis grass, Johnson grass, and sainfoin have been found less profitable than other plants that meet the same needs. Russian thistles may be used as an emergency hay crop, but their seeding is not advised.

[Report of field crops work in St. Vincent, 1918–19], F. Watts (*West Indies Imp. Dept. Agr. St. Vincent Agr. Dept. Rpt., 1918–19, pp. 6–8, 8–12, 20–30*).—Fertilizer experiments with Sea Island cotton and arrowroot, breeding work with cotton, cowpeas, bonavist bean (*Dolichos lablab*), and castor bean are reported, in continuation of previous work (E. S. R., 41, p. 528). Tabulated statistics are presented and discussed regarding the production of cotton, arrowroot and cassava starch, cacao, sugar, corn, coconuts, peanuts, and peas on the island.

Mulching arrowroot with Gliricidia prunings gave an average acre yield of 61,005 lbs. of rhizomes, compared with 17,845 lbs. from untreated plats. In comparisons of various organic and artificial fertilizers, a mulch of Gliricidia prunings led, producing 60,798 lbs. per acre, and was followed by sulphate of potash, 27,183 lbs., with 19,194 lbs. from the untreated check.

[Report of field crops work in British Guiana], J. B. Harrison (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 4–20*).—Experiments with sugar cane and rice described for the year ended December 31, 1918, in continuation of previous work (E. S. R., 41 p. 528), have been already noted (E. S. R., 43, p. 532; 44, p. 136) from other sources.

[Report of agronomy work at the Guam Station, 1919], G. Briggs (*Guam Sta. Rpt., 1919, pp. 23–30, 31, 32, 33, 34, 35, pls. 2*).—The continuation of work with field crops along the same general lines as heretofore (E. S. R., 42, p. 31) is described. The typhoon of July 6, 1918, which destroyed nearly all of the growing crops on the island; excessive rains following for three months; and an extended drought occurring during the last half of the year, combined to render the agronomic work very disappointing.

In fertilizer tests with Para grass, barnyard manure alone gave the most lasting results, and was followed in effectiveness by applications of large amounts of commercial fertilizer. Para grass planted with velvet beans produced 1,298

lbs. of green forage for the first crop and 3,220 lbs. for the second crop, as compared with 760 and 805 lbs., respectively, from plats of grass alone.

Paspalum grass withstood the typhoon, heavy rains, and extreme drought, and remained in better shape than any other grass or forage crop on the island. Cuttings of seed stems planted in boxes produced good growth, demonstrating that Paspalum can be propagated from seed stems as well as from seed and by root division. Work with Guinea grass, Sudan grass, Bermuda grass, and Guatemala grass (*Tripsacum laxum*) is also noted.

The sixth cutting of ratoon kafir yielded 2,292 lbs. of forage per acre, while that of ratoon sorghum produced 4,224 lbs. Feterita and yellow milo were the earliest of the grain sorghums, while Dawn and Blackhull were the most promising of the kafirs. Dawn kafir was outstanding in yields of seed and forage. Orange gave the best results in a limited test of sweet sorghums.

In legume tests, soy beans and Canada field peas were failures, while mungos produced a fair crop of beans and matured in less time than any other variety. Jack beans and velvet beans made slow growth in the dry season, but responded vigorously in the wet season. Jack beans were the only legumes withstanding the typhoon. Cowpeas gave good results in all cases and on all soil types, with New Era and Whippoorwill appearing well adapted for all purposes. In a forage test in which these varieties were planted broadcast and in drills 3 ft. apart, the drilled plats gave larger yields of peas, but the broadcasted areas gave slightly more forage. This also held true with mungo beans. Cowpeas proved the best cover crop for the long dry season, while velvet beans produced the best growth during the rainy season. Alfalfa was considered unsuited to the climate and environment.

Variety tests of root crops included arrowroot, cassava, sweet potatoes, taro, edible canna, and chufas. In a trial of edible cannas, a yield of 5,525 lbs. of tubers was secured between March and October.

All cotton varieties were killed by the typhoon.

In 10 generations of ear-to-row breeding work with corn, the characters of dwarfness of stalk, one ear, and early maturity have become fairly well fixed, but the yield has apparently decreased.

The maximum yield in fertilizer tests with rice, 2,070 lbs. of first-grade rice and 4.95 tons of straw, was produced by an application of 200 lbs. of ammonium sulphate and 166.5 lbs. of acid phosphate, as compared with 625.5 lbs. of first-grade rice and 4.62 tons of straw, the average of the unfertilized plats. Only the plantings made before October 1 made appreciable crops.

Orinoco tobacco produced 154.3 lbs. of leaves, as compared with 126 lbs. from the native tobacco, and also a larger number of first-grade leaves.

[Report of field crops work in Bengal, 1918–19], R. S. Finlow et al. (*Bengal Dept. Agr. Rpt., 1918–19, pp. 2–6, 7–9, 15–21, 22–25, 26, 27–30, 33–36, 40, 42–47, 50, 52–54, 58, 59, 64, 66, 67, 70–74, 77, 78, 81, 83–85, 86–89, 91, 92, 94–102*).—In continuation of similar work previously noted (E. S. R., 42, p. 132), this report describes variety, cultural, and fertilizer tests with jute, rice, corn, potatoes, sugar cane, tobacco, and miscellaneous field crops conducted at the several experimental centers in Bengal.

[Reports of field crops work in Fiji, 1917 and 1918], C. H. Knowles (*Fiji Dept. Agr. Ann. Rpts., 1917, pp. 3, 4, 5; 1918, pp. 4, 7, 8*).—Results of variety tests with yams, cultural experiments with rice, and field trials of corn, sisal, Mauritius and manila hemp, kapok, kawai (*Dioscorea aculeata*), kava (*Piper methysticum*), cassava, and miscellaneous field crops conducted at the Nasinu Experimental Station during 1917 and 1918 are reported, in continuation of similar work previously noted (E. S. R., 40, p. 231).

[Report of field crops work at the Partabgarh and Benares Agricultural Stations], L. C. SHARMA (*United Provs. Agra and Oudh Agr. Stas. East. Circle, Rpt. 1919, pp. 2–10, 2–5*).—Variety, cultural, rotation, and fertilizer tests with rice, sugar cane, wheat, barley, gram, peanuts, and miscellaneous crops are described in continuation of previous work (E. S. R., 40, p. 825) for the year ended June 30, 1919.

Cultural directions for field crops and vegetables, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 80–88, pls. 7*).—Cultural methods considered best in growing field crops and vegetables in the Philippines are described. Besides the crops commonly cultivated in the temperate regions, directions are presented for the culture of the marutong, patani, seguidilla, and sitao beans, and the adlay, anipay, aroro, apalia, batao, borona, cadios, camote, cassava, chayote, condol, curuba, gabi, guar, libato, nami, patola, pechay, upland ragi, sapang, sembu, sesame, sincama, talinum, tongo, ubi, upo, and yautia.

Handbook of breeding of agricultural plants, C. FRUWIRTH ET AL. (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung. Berlin: Paul Parey, vol. 1, 5. ed., rev., 1920, pp. XVIII+442, pls. 8, figs. 91; vol. 2, 3. ed., rev., 1918, pp. XVI+262, figs. 50; vol. 3, 3. ed., rev., 1919, pp. XVI+240, figs. 45; vol. 4, 3. ed., rev., 1919, pp. XVI+504, figs. 42; vol. 5, 1912, pp. XIX+184, figs. 32*).—This comprises five volumes, of which the fifth has been previously noted (E. S. R., 28, p. 736), as well as earlier editions of the first four volumes, as follows:

I, General Principles for the Breeding of Agricultural Plants (E. S. R., 32, p. 430); II, The Breeding of Corn, Fodder Beets, and Other Root Crops, Oil Seed Plants, and Grasses (E. S. R., 21, p. 543); III, Breeding of Potatoes, Jerusalem Artichokes, Flax, Hemp, Tobacco, Hops, and Leguminous Forage Plants including Clovers (E. S. R., 17, p. 1055); IV, The Breeding of the Four Principal Cereals and Sugar Beets (E. S. R., 24, p. 634).

Trials of exotic cereals in Algeria, L. DUCELLIER (*Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 26 (1920), No. 10, pp. 218–229*).— Results of tests of varieties of wheat, barley, and oats from European and other sources are reported. The European varieties exhibited a lesser drought and rust resistance, a longer period of winter dormancy, slower plant growth, and later maturity of grain than native African varieties.

Oil plants [in Uruguay], R. S. SILVEIRA ([*Uruguay*] *Min. Indus. Insp. Nac. Ganaderia y Agr. Bol. 37 (1920), pp. 21*).—The culture and utilization of peanuts, sunflowers, sesame, colza, and castor and soy beans in Uruguay are discussed.

A study of the influence of the root system in promoting hardiness in alfalfa, W. SOUTHWORTH (*Sci. Agr., 1 (1921), No. 1, pp. 5–9, figs. 6*).—A résumé of earlier work on the relation of root development to hardiness in alfalfa is presented, together with results of investigations conducted at the Ontario Agricultural College from 1909 to 1912. The author arranges the different root systems of alfalfa plants into three main types: True root system without underground stems, with single or branched taproot; branched taproot with well-defined underground stems; and branched taproot with buds and aerial roots as distinguished from underground stems.

From the observations and investigations it is considered that the capacity of alfalfa to withstand severe winter conditions depends very largely on its root system, plants possessing a branched root system withstanding winter heaving much better than those having only single taproots of whatever length. Those plants with the power to produce rooting underground stems have the ability to renovate themselves, and after the death of the main rootstock, can maintain a separate existence. Alfalfa plants spreading by means of root

proliferation possess a form of vegetative multiplication which promises to give the plant greater powers of cold resistence and of recuperation from injury than is possessed by even true rhizomes. This faculty may render possible the growth of good crops under adverse climatic conditions where the culture of common alfalfa would be quite impracticable.

First generation crosses between two alfalfa species, L. R. WALDRON (*Jour. Amer. Soc. Agron., 12 (1920), No. 4, pp. 133–143, figs. 4*).—This contribution from the North Dakota Experiment Station compares the amounts of growth made and winter injury sustained by F_1 hybrids between common alfalfa (*Medicago sativa*) and yellow-flowered alfalfa (*M. falcata*) with the growth made and injury sustained by the parent forms. Studies of cross-fertilization occurring between these species have been noted heretofore (E. S. R., 42, p. 32).

The hybrids showed a much greater weight per plant than either *M. sativa* or *M. falcata* plants grown under like conditions. The increase in weight was 47.5 per cent. The absolute variability of the hybrids was much greater than that of the parents. Data on length of stems of the hybrid and the nonhybrid plants did not show significant differences, and the increased weight per plant was considered probably due to the increased number of stems per plant. Although winter injury was comparatively slight, plants of *M. falcata* showed significantly less killing than the other groups.

On the evolution of the corn ear, N. B. MENDIOLA (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 112–114, pls. 4*).—The author presents and discusses illustrations showing several stages in the transition between the ear and tassel of corn in support of the theory of Montgomery (E. S. R., 17, p. 757) that the ear of corn originated directly from the central spike of some tassel-like structure similar to the corn tassel.

The inequality of reciprocal corn crosses, F. D. RICHEY (*Jour. Amer. Soc. Agron., 12 (1920), No. 6–7, pp. 185–196, fig. 1*).—In this contribution from the U. S. Department of Agriculture, the yields of three pairs of reciprocal crosses between Boone County White, Fraley Yellow Dent, and U. S. Selection No. 120 are compared, inequality being shown in each pair of crosses. The author observes that a difference in the food materials furnished the young plants by the several maternal parents and a difference in germinal reactions with diverse cytoplasms have been suggested as possible causes of such inequalities, and states that the unequal transmission from Fraley Yellow Dent as a staminate and as a pistillate parent shows that some type of sex-linked inheritance must at least be considered as a possible cause of inequality between reciprocal corn crosses.

Reproducing power of well-filled v. poorly-filled ears of maize, C. P. HARTLEY and H. S. GARRISON (*Amer. Nat., 55 (1921), No. 637, pp. 184–187, fig. 1*).—Tests to determine the effects on the progeny, particularly on productivity, when a stalk of corn is caused to produce comparatively few kernels instead of a normal-sized, well-filled ear are described. Pollination in three different varieties was so controlled as to produce some ears with a few large rounded kernels scattered over the cob, and other ears the butt ends of which were fairly well filled about one-fourth the cob length. Seeds from these lots were compared with those from typical well-filled seed ears matured unmolested in the same rows from similar stalks grown under like conditions.

No differences in growth, height of stalk, or time of silking, tasseling, and maturing were noted among the three lots. With all three varieties the well-filled seed ears produced the highest yields, the increase ranging from 2.2 to 3.9 bu. per acre over the next highest lot. In 25 comparisons between the two lots, the normal seed outyielded the seed from the ears with scattered kernels, its nearest competitor, 16 times, with one tie; and it outyielded the seed from

the ears fairly well filled at the butt ends 20 times, with two ties. The ears harvested from each of the three lots of seed were equally well filled and of the same general appearance. These results are held to warrant the conclusions that ears poorly filled by reason of withheld pollination will not transmit this character to their progeny, and can be expected to supply seed almost as productive, if not equally so, as that supplied by ears completely pollinated.

Corn at Holly Springs Branch Experiment Station, C. T. AMES (*Mississippi Sta. Bul. 189 (1920), pp. 8*).—Results of variety trials and fertilizer tests with corn on the brown loam soils are reported, together with information on methods of preparation and cultural practices considered best for grain and silage production on these soils.

Maximum acre yields in 1920 were made by Tennessee Red Cob with 61.1 bu. and Paymaster (Harpeth) 61.6 bu., while in 1919, two prolific varieties, Cockes with 80.4 bu. and Mosby (Woodruff) with 71.2 bu., were leaders. Yields for 40 varieties of corn, grown during different periods from 1912 to 1920, are tabulated.

In fertilizer tests in 1917, the highest yield, 25.8 bu., was secured from an application of 200 lbs. of acid phosphate and 200 lbs. of cottonseed meal, as compared with 15.4 bu. from the adjacent unfertilized check. In 1919 tests, 100 lbs. of sodium nitrate per acre after the first working gave a maximum of 48.2 bu., as compared with 38.1 bu. from the adjacent check. The plat receiving 250 lbs. of cottonseed meal at planting returned 47.3 bu., while corn sown in 6 ft. rows with velvet beans between made 36.7 bu.

Microscopic diagnosis of the cotton species, R. HALLER (*Mikroskopische Diagnostik der Baumwollarten. Wittenberg: A. Ziemsen, 1919, pp. 52, pls. 3*).—Efforts to identify the individual species of cotton in raw fiber and unfinished yarn and textiles are described. The author presents a classification of the species and varieties pertaining to the genus Gossypium, and differentiates the individual species by peculiarities of the leaves, bracts, and seed. The method of procedure and preparation of material are outlined, and observations on each species are set forth in detail. Microphotographs of the upper and lower leaf surfaces and palisade cells of the seed coats of the principal species and varieties studied are included.

Cotton fertilization experiments, 1920, F. H. SMITH and T. S. BUIE (*Georgia Sta. Bul. 137 (1920), pp. 27–36, fig. 1*).—Continuing previous work (E. S. R., 43, p. 136), this describes comparisons of four types of raw phosphates as phosphorus sources for cotton crops on a very fertile soil, second year in cotton; a similar soil sown in peas the previous year; a fairly good soil in alfalfa a number of years previously; and a medium fertile soil, second year in cotton.

No one form of phosphate showed superiority over the others, and no advantage accrued from grinding mineral phosphates to extreme fineness. Ground natural phosphate gave indications that it may furnish phosphorus to the cotton plant during the first season of application and apparently continue to supply phosphorus to the crop the following year. When applied two successive years, natural phosphates produced yields comparing favorably with those from acid phosphate. Natural phosphate treated in a compost heap made better cotton yields than when used untreated. Plats top-dressed with various forms of phosphates gave 26 per cent increase over plats not top-dressed, with acid phosphate producing the greatest gains of the forms used.

Except when mineral phosphates were used with a 0:3:3 fertilizer, cotton yields on a neutral soil were not increased by the addition of 2,000 lbs. of ground limestone. With other fertilizing practices limestone treatment depressed the production of cotton.

Potash additions are not considered essential to cotton production on heavy clay soils of the Piedmont type, as the highest yields of cotton were obtained from 600-lb. applications of 8:3:0 and 8:3:2 fertilizers. Medium clay soil required potash, but the use of higher potash content than that supplied in the 8:3:3 formula was not shown to be advantageous. In the case of the sandy soil, the heaviest application of potash, 8:3:9, gave the best returns, the yields increasing with the amount of potash supplied.

Average yields on a fertile soil for a 5-year period show that the rate of increase in cotton production was greatest for the first 200-lb. application. With the application of complete fertilizers the rate of increase in yield remained constant for additions heavier than 400 lbs. per acre.

[Cotton foliage resists sprays and dust mixtures], H. P. STUCKEY (*Georgia Sta. Rpt. 1920, p. 7*).—The use of a large number of spray compounds against the boll weevil on cotton in the active stage of growth showed that cotton foliage possesses a remarkable resistance to sprays and dust mixtures. It is said that almost any standard summer strength spray can be used on cotton with safety.

Cotton varieties, T. S. BUIE (*Georgia Sta. Bul. 136 (1920), pp. 15–22*).—In further tests (E. S. R., 41, p. 32; 43, p. 136), College No. 1 and Texas Burr gave the highest amount of seed cotton picked to October 1, and these varieties, together with Piedmont Cleveland, Scott Cleveland, Ezy Muny, and Cook 1214, produced the highest total yields of 25 varieties. Considerable variation was noted in Cleveland, the several strains occupying positions from the second to twenty-fourth in the list. The yields of long staple varieties were near or below the average.

In the period 1917–1920 four strains of Cleveland, Georgia Station, Steinheimer, Piedmont, and Scott, led with average acre yields of 2,018, 1,942, 1,931, and 1,900 lbs. of seed cotton, respectively. In a comparison of the average yields of 1919 and 1920 two years after boll weevil infestation, with those of 1917 and 1918, two years before boll weevil infestation, Piedmont Cleveland remained outstanding with 93.9 per cent of the pre-weevil yield. The average yield of three Cleveland strains under boll weevil conditions was greater than any other variety except King, where the percentage was slightly higher, but the yield considerably less.

Brief notes on wilt-resistant and long staple varieties are included, together with suggestions for cotton culture under boll weevil conditions.

[Breeding of wilt-resistant varieties of cotton in Alabama], H. B. TISDALE (*Alabama Col. Sta. Circ. 44 (1921), pp. 16, 17*).—Leading wilt-resistant varieties of cotton, as determined by tests on wilt-infected land in Alabama, include Cook No. 307–6, Tri-Cook, Toole, Lewis No. 63, and Hybrid No. 189. It appeared that by planting cotton rather thickly on wilt-infected soil and thinning later than usual, the weaker plants die before thinning, thus giving ultimately better stands of cotton than obtained by the usual methods.

Comparative spinning tests of Meade and Sea Island cottons, W. R. MEADOWS and W. G. BLAIR (*U. S. Dept. Agr. Bul. 946 (1921), pp. 5*).—Comparative spinning tests of Meade (E. S. R., 40, p. 237) and Sea Island cottons grown during the seasons of 1916–17, 1918–19, and 1919–20 are reported. Grades for 1916–17 and 1918–19 tests were practically equal, while those of 1919–20 were represented by a mixture of Meade grading No. 2½ grown on sandy soil, another mixture of Meade grading No. 3 from clay soil, and a mixture of Sea Island grading No. 1½. The staple was 1⅛ in. for all three seasons, excepting that of the Meade from clay soil which pulled 1 7/16 in.

The averages of the results of the three seasons' tests showed that on the pickers, Meade was 0.82 per cent more wasty than Sea Island; on the cards,

1.4 per cent; and on the combers, 1.94 per cent; making a total of 3.5 per cent.

Comparisons of the breaking strength of Meade and Sea Island yarns for the three seasons revealed a difference of 17.2 lbs. in favor of Sea Island for the 23's yarn and 1.68 lbs. for 100's yarn.

Manila hemp, S. G. WILLIAMS (*Sci. Amer. Mo., 3 (1921), No. 2, pp. 255–257, figs. 8*).—Primitive methods of obtaining fiber from the wild banana plant (abaca) in the Philippines are described and illustrated.

Report of potato investigations, C. F. CLARK (*Colorado Sta. Bul. 261 (1921, pp. 34, figs. 6*).—This is a progress report of potato investigations, including variety trials, seed sources, marketability, running-out, storage and greening studies, and size of seed and irrigation tests. The work was conducted by the U. S. Department of Agriculture at the Colorado Potato Experiment Station at Greeley, in cooperation with the commissioners of Weld County and the station.

Pearl and Rural New Yorker gave the most satisfactory results in variety tests. While Rural New Yorker gave lower yields than Pearl, it produced much smoother tubers and less culls. Green Mountain, Peachblow, and Russet Burbank have given good yields, but they possess various faults unsuiting them to the conditions in the Greeley district. Of the early varieties tested, Early Ohio yielded considerably less than Irish Cobbler and Charles Downing. Irish Cobbler was not apparently suited to the local conditions as the vines showed lack of vigor and the tubers were elongated with very deep eyes.

In four-year tests with Pearl seed the best yields were made by Colorado dry-land seed, followed by Wisconsin and Colorado irrigated seed in the order named. The best yields of Rural New Yorker were obtained from Wisconsin stock, with New York seed following closely. Studies of the relative yields of all varieties in the experiment showed the relatively high quality of Colorado dry-land and Wisconsin seed.

The average storage losses during the years 1915, 1916, and 1918 were 7, 7.8, and 7.6 per cent, respectively, but in 1917 damage from frost injury was held to be the cause of the greater average loss, 9.1 per cent. It is held that the wide variation in losses from different varieties in the given season does not indicate that the extent of the loss may be a varietal characteristic, although losses may be associated with certain relations of the variety to conditions. Of 24,480 lbs. of tubers removed from the field and stored in sacks, 918 lbs., or 3.6 per cent, was dirt, the weight of which constituted about one-half the total shrinkage. Where Rural New Yorker potatoes were stored clean in barrels in a cellar at 40° F. from November 30 to April 3, a loss of only 1.1 per cent was recorded.

In percentage of marketability, Russet Rural, Rural New Yorker, and Green Mountain, with 96.9, 95.7, and 92.2 per cent, respectively, were the leading varieties, while Russet Burbank, with 72.2 per cent, was the lowest.

Rural New Yorker appeared to be very nearly immune to diseases responsible for one form of degeneracy. Excepting new seed, Pearl and Peachblow were badly affected with mosaic disease, which increased in intensity with the length of time that the seed stock was grown at the station, accompanied by a gradual diminution of yield. In comparative tests, pear-shaped tubers of the Rural New Yorker variety, characteristic of a certain form of degeneracy, produced a crop equal in quantity and quality to that produced by the good type of seed tubers, indicating that all pear-shaped tubers are not run out.

Seed spring greened produced somewhat larger returns than ungreened seed in three years' experiments, while fall greened seed gave yields lower than seed not greened.

In time of irrigation tests, early irrigation gave the largest yields in all cases; omission of one application resulted in yields significantly less than the standard check, and large decreases followed the withholding of water until late in the season. Early irrigation resulted in the largest percentage of marketable tubers.

Results of size-of-seed experiments, 1915–1918, showed whole seed to consistently produce better stands, larger total yields, and generally more marketable tubers than cut seed. It also produced a greater number of tubers per hill, which, however, generally averaged smaller in size than those grown from cut seed. Where the seed was subjected to unfavorable conditions during the period of germination a direct relation between the size of seed piece and yield appeared, but this relation was not apparent when conditions were favorable; in fact, deducting from marketable tubers the amount of seed used, the larger sizes were found to be less economical. The results indicate that while the best size may vary with conditions, it should equal or exceed 2 oz. in weight.

First annual report of the Nebraska Potato Improvement Association (*Nebr. Potato Impr. Assoc. Ann. Rpt., 1 (1919), pp. 160, figs. 44*).—This reports the first annual meeting of the association, held at Rushville in November, 1919, and outlines the activities of the association during 1919. Besides the text of the Nebraska potato grading law, the following papers presented at the meeting are included: Soil Moisture Conservation in Dry Land Soils, by L. L. Zook (pp. 25–45); The Colorado Potato Beetle and Its Control, by M. H. Swenk (pp. 49–57); The Work of the Colorado Potato Experiment Station, by W. C. Edmundson (pp. 57–65); Potato Disease Control in Minnesota, by A. G. Tolaas (pp. 73–78); Control of Dry Rot and Fusarium Wilt of Potatoes, by E. M. Wilcox (pp. 79–83); The Seed Potato Industry as Related to Western Nebraska (pp. 83–99), and Potato Experimental and Extension Work of the University of Nebraska (pp. 138–143), both by H. O. Werner; The U. S. Bureau of Markets and Its Relation to the Potato Industry, by W. A. Sherman (pp. 99–105); Trade Channels for Nebraska Potatoes, by C. H. Heard (pp. 108–118); and Why Does the Government Estimate the Potato Crop? by A. E. Anderson (pp. 118–122.)

Relation of flowering time and the position of flowers on the panicle branch to the kernel weight of rice, Y. Yamaguchi (*Ber. Ōhara Inst. Landw. Forsch., 1 (1919), No. 4, pp. 451–517, figs. 35*).—Studies of the relation of the flowering time and the position of the flowers on the panicle branch to the kernel weight of rice are described. The material used in the experiment included typical panicles of the Shinriki, Omachi, Karasu-Mochi, Kazusa-Kobore, and Shima-Nishiki varieties.

In order to clarify the process of study, the division of the flowering sequence of a panicle into the flowering succession of the panicle branches and the flowering succession within the individual branch is suggested. The flowering sequence of the panicle branches proceeds regularly from above downward, while within the individual branches the flowers generally follow the succession: 1, 7, 6, 5, 4, 8, 3, 11, 2, 15, etc.

Concerning the relation between the actual flowering days and the kernel weight, the heaviest kernel in the whole panicle, as well as within the single branch, did not usually develop in the first blooming flower, but in one of the flowers blooming on the second, third, or later days. In general, the earlier the flower bloomed the heavier the grain within developed. The agreement between these qualities was not so large as expected, as the correlation between the observed flowering time and the weight of the glumed or naked kernel was negative and slight. The glume weight, on the contrary, was correlated strongly with the flowering time.

The heaviest glumed or naked kernel, within the panicle branch as well as within the whole panicle, was found usually on the third, fourth, or fifth position on a branch. The heaviest glume, however, was found on the first, fifth, or sixth position. The highest average weight of both glumed and naked kernels on a given position on a branch was situated likewise at the fourth, fifth, and sixth positions. However, the highest average weight of glume on a given position was situated, like the heaviest glume, at the first or fifth and sixth positions.

The sequence of the average weight of a panicle on a given position on a branch usually ran parallel with the average flowering sequence of a panicle branch, and the curves of both agreed better than in the case of the relation between the actual flowering time and the corresponding kernel weight. Contrary to this, most of the curves of the sequence of the average kernel weight of the whole branches and of the flowering sequence for the whole branches did not run parallel. The average kernel weight was usually larger on the lower branches.

The negative correlation between position and kernel weight was generally larger than that between the actual flowering time on a whole panicle and the kernel weight corresponding to this flowering time. This was especially the case with glume weight. A moderate positive correlation between the glume weight and the weight of the naked kernel was observed.

Temporary roots of the sorghums, J. B. Sieglinger (*Jour. Amer. Soc. Agron., 12 (1920), No. 4, pp. 143–145*).—Under conditions in which Kanred wheat and Mexican June corn produced averages of 3.77 and 4.42 temporary roots (including the radicle) per plant, sorghums of the milo-durra, kafir, kaoliang, and broom-corn groups had but one temporary root, the radicle. In the sorghums, the first node develops shortly after germination, and from this node the first permanent roots grow.

The culture of sorghums for forage [in Uruguay], J. Puig y Nattino ([*Uruguay*] *Min. Indus., Insp. Nac. Ganaderia y Agr. Bol. 39 (1920), pp. 82, pl. 1, figs. 19; also in Uruguay Rev. Min. Indus., 8 (1920), No. 54, pp. 279–355, pl. 1, figs. 19*).—Information is presented dealing with the culture, adaptation, feeding, and ensiling of forage sorghums in Uruguay. Considerable agronomic data and analyses of pink kafir, milo, amber sorghum, dwarf broom corn, Sudan grass, and other sorghums are tabulated. The author treats the hydrocyanic acid factor at length, and includes detailed notes regarding the influence of growth periods and meteorological conditions on the presence of this poison. A practical method of determining the amount of hydrocyanic acid in sorghums by the use of Guignard's paper is outlined, together with a chromatic scale of the distinct reactions of hydrocyanic acid when occurring in different intensities.

[Experimental work with sugar cane in Queensland], H. T. Easterby ([*Queensland*] *Bur. Sugar Expt. Stas. Ann. Rpt., 19 (1919), pp. 37; 20 (1920), pp. 40*).—Continuing work noted heretofore (E. S. R., 40, p. 634), these reports review the progress of the cane-sugar industry in Queensland in 1919 and 1920, present tabulated field and analytical data on new and introduced varieties, and report the result of cultural and fertilizer tests conducted at the sugar experimental stations at Mackay, South Johnstone, and Bundaberg. Tops, middles, and middles and bottoms of Badila cane planted for seed at Bundaberg gave total acre yields of 78.63, 57.23, and 56.68 tons of cane, respectively, from three crops.

Java sugar cane culture, past and present, G. E. G. Vonstietz (*La. Planter, 66 (1921), No. 10, pp. 158, 159*).—A brief historical and economic survey of the development of the sugar industry in Java, together with data on the cost of production.

Sweet potato culture in Missouri, J. T. Rosa, jr. (*Missouri Sta. Circ. 103 (1921), pp. 12, figs. 6*).—A general discussion of practices considered essential to the successful production of sweet potatoes in Missouri.

Results obtained from an extensive test of various commercial fertilizers at Columbia in 1920 did not suggest a special need for commercial fertilizers by sweet potatoes when grown on land of fair fertility in Missouri. In variety tests conducted at Columbia, Strassburg, Red Bermuda, and Southern Queen led, with respective acre yields of 546.7, 489.9, and 461.2 bu., with No. 1 potatoes averaging in weight 16.6, 13.6, and 13.3 oz., respectively. An outstanding result of this test was the relatively low yield of varieties of the Jersey type, and the high percentage of No. 2 or "seed-size" roots in these varieties.

The cost of producing tobacco in Kentucky, W. D. Nicholls and F. W. Peck (*Kentucky Sta. Bul. 229 (1920), pp. 133–190, figs. 12*).—A preliminary report of studies of the cost of producing tobacco in Kentucky is presented. The work was in cooperation with the U. S. Department of Agriculture and was conducted on 81 farms in the Burley district, covering 625.5 acres of tobacco, and on 70 farms in the dark tobacco district growing 679 acres. The agricultural and environmental conditions prevalent in the districts are described, and the results of the studies are tabulated and discussed.

In the Burley district the tobacco acreage per farm ranged from 1.2 to 36.6 acres, averaging 7.7 acres. Yields per acre ranged from 278 to 2,224 lbs., with an average of 1,141 lbs. On the farms studied the total cost per acre, including land rent, ranged from $163.06 to $403.18, averaging $289.10. Over one-half of the acreage was produced at between $200 and $300 per acre. The cost per pound varied from 15 to 81 cts., averaging about 26 cts., and with 90 per cent grown at 31 cts. or less. Of the total costs in this district, man labor constituted 42 per cent, land rent 34.3 per cent, barns and sticks 9.6 per cent, horse labor 6.7 per cent, insurance 4 per cent, and machinery and miscellaneous costs amounted to 2.9 per cent.

In the dark tobacco area the tobacco acreage per farm averaged 9.7 acres, with the largest 42 and the smallest 2.5 acres. The highest yield per acre was 1,876 lbs., the lowest 304 lbs., and the average 825 lbs. The total cost per acre ranged from $100.03 to $308.19, averaging $141.76. Over one-half of the acreage was grown at a cost of $125 to $150 per acre. In this area the cost per pound varied from 9 to 38 cts., with an average of 17.2 cts. Over 90 per cent of the tobacco was produced at 23 cts. per pound or less. In this area man labor made up 49.4 per cent of the total cost, land rent 7.8 per cent, horse labor 12.6 per cent, barns and sticks 7.1 per cent, insurance 4.4 per cent, and other items 8.7 per cent.

In both districts when land rent was excluded as a charge, man and horse labor amounted to approximately 75 per cent and the other items 25 per cent of the total cost. In each district the combined operation of stripping and marketing was the principal labor item, with cutting and housing second in the Burley district, and topping, worming, and suckering second in the dark tobacco district.

Wheat varieties of the Sahara, L. Ducellier (*Les Blés du Sahara. Algiers: Govt., 1920, pp. 56, figs. 14; also in Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 26 (1920), Nos. 6, pp. 97–109, figs. 3; 7, pp. 131–146, figs. 6; 8, pp. 161–170, figs. 2; 9, pp. 185–196, figs. 2*).—The varieties of wheat grown in various regions of the Sahara desert are described and classified, and practices employed in their culture outlined. The future of wheat production in the Sahara desert region is discussed in some detail.

Varieties of wheat tested in New South Wales, J. T. Pridham (*Agr. Gaz. N. S. Wales, 32 (1921), No. 1, pp. 10–19*).—Tabulated information regarding

249 varieties of wheat from different parts of the world tested by the Department of Agriculture of New South Wales is presented. The data include the season, use, class, origin, districts for which suitable, distinguishing characters, good points, and defects of each variety.

Colorado weed seeds, G. E. EGGINTON (*Colorado Sta. Bul. 260 (1921), pp. 91, figs. 164*).—Descriptions and accurate enlarged illustrations of seeds of a large number of weeds arranged by families are presented, together with a descriptive key for the identification of seeds of the principal families of weeds. The occurrence of weed seeds in commercial seed is discussed, and the structure of typical seeds is illustrated and described in detail.

Lawn pennywort, a new weed, A. A. HANSEN (*U. S. Dept. Agr., Dept. Circ. 165 (1921), pp. 6, figs. 3*).—Lawn pennywort (*Hydrocotyle rotundifolia*), introduced from southern Asia as an ornamental, is considered to be a weed particularly undesirable on golf greens and lawns. The plant and its habits of growth and distribution are described and eradication methods indicated. Digging and burning or otherwise destroying the plants and reseeding the lawn after fallowing for at least two weeks is considered the most efficacious method of eradicating the weed. Experiments to eradicate this weed by spraying with solutions of common salt, arsenic, iron sulphate, and gasoline were without success.

HORTICULTURE.

Black's gardening dictionary, edited by E. T. ELLIS (*London: A. & C. Black, Ltd., 1921, pp. XVI+1238, figs. 42*).—A compilation of practical horticultural information prepared for the use of modern English amateur and professional gardeners. The alphabetically arranged subject matter is treated in simple popular style and includes numerous contributions from prominent gardeners and specialists. A garden work calendar is included.

[Report of horticultural investigations in Guam], G. BRIGGS (*Guam Sta. Rpt. 1919, pp. 38–44, fig. 1*).—The horticultural activities for 1919 were largely of a reconstructive nature, due to the devastation caused by a typhoon, July 6, 1919. The plant and propagating houses were completely destroyed and many trees uprooted or otherwise badly damaged. Very little fruit of any kind was produced during the season, though papayas, bananas, pineapples, avocados, and mangoes yielded small crops. A small citrus orchard, consisting of oranges, lemons, limes, and tangerines, was established during the year. The rose apple (*Eugenia jambosa*), introduced in 1910 from the Philippines, produced a good crop of fruit. A list of fruit trees and plants growing at the station is included.

The Cristobal tomato, developed at the station, continues to improve with selection and is considered very promising. A Hawaiian hybrid tomato, introduced during the year, is also of promise. In a variety test, the above tomatoes greatly outyielded other better known kinds.

Experiments with coconuts indicated that clean tillage without fertilizers resulted in a better growth than no tillage and fertilizer. Different methods of copra making were also tested, green nuts showing a shrinkage as high as 72.03 per cent after 11 days' drying, while with ripe nuts it was as low as 26.26 per cent. The best copra was made from nuts that had just sprouted, but fully matured, and well-cured nuts which had fallen to the ground were a close second in yield and gave the best grade of product. Copra cut out of the shell when the nuts were first opened was superior to that allowed to remain in the half shell until loosened by shrinkage. Nuts dried on a bamboo frame raised from the ground about 2 ft. gave a slightly better quality of copra than those left on a mat on the ground.

[Report on horticultural investigations in Illinois] (*Illinois Sta. Rpt. 1920, pp. 20–22*).—In a soil treatment experiment in an apple orchard at Neoga, the plats receiving leguminous cover crop and complete chemical fertilizer ranked highest in production and size of tree. First-year results in a 3-year experiment in methods of planting orchard trees, at Urbana, indicate that moderately pruned trees bear more new growth than severely pruned ones. Fertilization of the roots killed all trees receiving this treatment. Studies with Lima beans indicate that seed inoculation may be an important factor in increasing yield.

The control of garden insect and fungus pests, V. VERMOREL and E. DANTONY (*La Défense de Nos Jardins contre les Insectes et les Parasites. Villefranche-Montpellier: Prog. Agr. et Vitic. [1921], pp. 232, pls. 12, figs. 67*).—A practical treatise, presenting information relative to the more important injurious insects and fungus diseases of fruit and vegetable plants and means for their control. Insecticidal and fungicidal formulas are given, and a spray calendar is included. Twelve colored plates, 10 of insects and 2 of fungi, are appended.

Plant inspection in Missouri, K. C. SULLIVAN (*Missouri Sta. Circ. 101 (1920), pp. 16, figs. 5*).—A review of the activities of the Plant Inspection Service of Missouri from its inception in 1913 through 1920.

In 1920 approximately 100 plant nurseries were inspected, a careful but fruitless search was conducted for the European corn borer, and sweet potatoes and sweet potato slips leaving Missouri were inspected. A note is made of certain menacing insects and diseases not yet present in the State.

Seed growing on eastern Long Island, L. ALLEN (*Conn. Veg. Growers' Assoc. Rpt., 1919, pp. 5–12, figs. 2*).—A popular discussion of the author's methods of growing seed of cabbage, kale, Brussels sprouts, and spinach.

Pomological progress in New Brunswick, A. G. TURNEY (*Sci. Agr., 1 (1921), No. 4, pp. 175–177*).—The development of fruit growing in the Province of New Brunswick is discussed, and the origin of Sharp's New Brunswick, Woodstock Bloom, Munro Sweet No. 1, Walden, and Crimson Beauty apples is noted.

Reports of the Fruit Experiment Station, Shillong, for the nine months ending March 31, 1919, and the year ending March 31, 1920, C. H. HOLDER (*Assam Dept. Agr. Expts. Rpts., 1919, pp. 45–73; 1920, pp. 46–75*).—Records are given of the varieties of orchard and small fruits on trial at the station, with brief notes on their behavior during the periods. Several well-known American varieties are included; the majority, however, are of European origin.

Reports of the director of fruit culture, A. H. BENSON (*Queensland Dept. Agr. and Stock, Ann. Rpts., 1918–19, pp. 50–54, pls. 3; 1919–20, pp. 47–53, pl. 1*).—Notes are given on bananas, pineapples, citrus fruits, custard apples, mangoes, grapes, deciduous fruits and vegetables. Tables showing the exports and imports of horticultural products for the respective years are included.

How to prune small fruits, J. G. MOORE (*Wis. Agr. Col. Ext. Circ. 134 (1921), pp. 8, figs. 3*).—Popular instructions are given for pruning the grape, raspberry, blackberry, currant, and gooseberry.

Spring spraying program for 1921, A. FRANK (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 182–186*).—A spraying program is outlined for apples and pears. The more common disease and insect pests of the apple, pear, peach, plum, and cherry are considered separately and specific remedies for each given.

Spraying and dusting, G. E. SANDERS (*Marit. Farmer and Coop. Dairyman, 26 (1921), No. 11, pp. 294, 295, 314, 315*).—In this address, presented before the

Nova Scotia Fruit Growers' Association, at Windsor, N. S., the present status of dusting in apple orchards is discussed. The history and development of the more common spray materials for apples are reviewed.

Experiments with various dust mixtures in an orchard at Berwick, N. S., in 1920, indicate that copper arsenic dust, in the proportion of 4 per cent metallic copper and 1.25 per cent metallic arsenic, is superior to the sulphur lead arsenate mixture, both in disease and insect control. Copper arsenic dusted trees yielded 57.5 per cent No. 1 fruit, sulphur lead arsenate 34 per cent, check 19.2 per cent. Time of application experiments showed invariably that early morning dusting is preferable, particularly for scab control. The mixture of lead arsenate and sulphur proved more effective than straight sulphur in disease control.

A dust calendar is included.

Arsenical and mixed sprays for fruits, P. MARCHAL (*Min. Agr. [France], Ann. Serv. Épiphyties, 6 (1918), pp. 242–280*).—A compilation of information on the spraying of fruit trees with arsenicals, singly or in combination with other materials. The subject is treated under four general headings, (1) the treatment of fruit trees in America, (2) the treatment of fruit trees in France, (3) the relation of arsenical treatments to health, and (4) experiences of 1917. A fairly complete bibliography is included.

Studies on the Amygdalaceae and pome fruits of cold portions of Indo-China and South China, A. CHEVALIER (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 19, pp. 1127–1129*).—This includes an account of the peach, almond, prune, apricot, cherry, apple, and pear as cultivated in high portions of Asia.

Quince (*Agr. Jour. Egypt, 9 (1919), pp. 129, 130, pl. 1*).—A varietal study of quinces at Gîza, Cairo, indicated the value of Rea Mammoth.

Horticulture, J. F. DUGGAR (*Alabama Col. Sta. Circ. 44 (1921), pp. 8, 9*).—The value of nitrate of soda as a factor in increasing the yield of Satsuma orange trees and in restoring a freeze-injured orange orchard to a productive condition is noted.

Growing annual flowering plants, L. C. CORBETT and F. L. MULFORD (*U. S. Dept. Agr., Farmers' Bul. 1171 (1921), pp. 83, figs. 66*).—A contribution from the Bureau of Plant Industry containing popular information on the use, propagation and culture of annual flowering plants. The plants are grouped according to height at maturity. A list of plants suitable for special environmental conditions, and a table showing the principal characteristics of many annual plants, are included.

Wild flowers of New York, H. D. HOUSE (*N. Y. State Univ., State Mus. Mem. 15 (1918), pts. 1, pp. 185, pls. 143, figs. 114; 2, pp. 186–362, pls. 121, figs. 16*).—A two-part memoir devoted to the wild flowers of New York State. The text is made up of simple botanical descriptions, accompanied by several hundred remarkable color illustrations of many of the species. Indexes to illustrations and subject matter are included in the second volume.

FORESTRY.

Conifers and their characteristics, C. COLTMAN-ROGERS (*London: John Murray, 1920, pp. XIII+333, pls. 4, figs. 5*).—A popular treatise on the coniferous family, in which the trees are arranged according to botanical classification and the distinguishing characteristics of each species are pointed out. Many observations of an historical and literary nature are included. A series of identifying tables, containing brief technical descriptions of the many species, is appended.

The morphology of wood in relation to brashness, C. C. FORSAITH (*Jour. Forestry, 19 (1921), No. 3, pp. 237–249, pls. 2*).—A contribution from the New York State College of Forestry, Syracuse University, relating to the causes of brashness (brittleness) in the woods of bald cypress, tulip poplar, and white ash. Determinations of specific gravity, percentages of ray tissue and summer wood, and microscopic measurements of the tracheids of strong and brash wood of the three species are presented in tabular form.

"Brashness is increased by a decrease in the amount of summer wood, by a decrease in the thickness of the tracheid or fiber wall, by a decrease in the volume of the fibers, by an increase in the volume of the wood rays and storage parenchyma, and by an increase in the number and size of the bordered pits. In the conifers the proportion of thick-walled summer tracheid and thin-walled spring tracheids determines strength or weakness except as this may be influenced by the rays, resin canals, and storage parenchyma. In the diffuse-porous woods the percentage of fibers, the thickness of their walls, and the volume of the rays and vessels bear a like relation to resistance. In the ring-porous woods there is added a new feature, the width of the specialized summer area. This area (the spring increment being constant) increases the tendency to brashness as it decreases in amount.

"Failure in wood either due to flexure or compression is directed by the vessels and rays. The fibers, the last to give way, break horizontally, split in the thin-walled cells, or separate along the middle lamella in the thick-walled type. Separation at the ends is uncommon.

"Variations in the specific gravity are quite closely proportional to variations in the volume of the fibers and the thickness of the lignified walls, and less frequently inversely proportional to the volume of the vessels and rays. Fiber length varies independently of variations in specific gravity, and cell size is more or less constant without regard to weight. The length of the fibers is not important in determining brashness."

Further notes on intercellular canals in dicotyledonous woods, S. J. RECORD (*Jour. Forestry, 19 (1921), No. 3, pp. 255–266*).—A second report (E. S. R., 39, p. 145), in which data on many additional woods are presented. A list of families of dicotyledons in which intercellular canals have been found is included. Twenty-seven references to literature are cited.

A plea for recognition of artificial works in forest erosion control policy, A. LEOPOLD (*Jour. Forestry, 19 (1921), No. 3, pp. 267–273*).—The author discusses the factors which lead to the erosion of forest lands, particularly stream valleys and sodded open uplands, and points out the necessity of supplementing a proper system of grazing control by artificial control works, such as crude dams, tree planting, etc.

DISEASES OF PLANTS.

Notes on weeds and plant diseases [Colorado], W. L. MAY and J. G. LEACH (*Colo. State Ent. Circ. 28 (1920), pp. 40–46, pl. 1, fig. 1*).—Following a report by May on phases of the whorled milkweed problem in Colorado, Leach gives a brief, systematic account of the barberry eradication campaign as conducted in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, and the Colorado Agricultural College, including the results of the year's work and an outline of plans; also a brief report on the canker of poplar and willow, which has proved to be very prevalent and destructive throughout the southern half of Colorado. This disease is evidenced by cankers formed on the branches and trunks of the trees affected. Infection usually takes place through injuries. The disease is caused by the fungus *Cytospora chrysosperma*, which

is characterized by the bright red exudate which it forms on the surface of the diseased bark.

Recommendations for control of the disease include selection of resistant species, protection, abundant water, strict supervision of nursery stock, and destruction of all material known to be infected.

[Plant disease investigations of the Georgia Station] (*Georgia Sta. Rpt. 1920, pp. 4, 5*).—It is claimed that field and greenhouse experiments have shown that the mosaic disease of peppers is distinct from a similar disease of the wild pokeweed, and that pepper mosaic is not soil transmitted. Other experiments are said to indicate that among both fruits and vegetables are strains resistant to the root-knot nematode, and this fact is taken as the basis for studies on factors underlying such resistance.

Studies were made of spermatia of the higher Ascomycetes, and the complete life histories of eight species have been worked out. The results are said to indicate that the occurrence of spermatia is quite general in many groups of Ascomycetes, that they occur in conjunction with the early development of ascocarps, and that they are not propagative structures but seem to be sexual elements associated with the development of the ascus.

A brief report is given of some investigations on the Fusarium wilt of tomatoes in which it is stated that infection occurs most commonly through any of the softer tissues of the plant, but that the fungus is not able to penetrate mature cells if the walls are at all thickened. Tests were made of the wilt resistance of wild tomatoes from tropical America, and none of the five varieties showed any immunity to disease.

Field tests are reported upon for the control of tobacco root rot through soil disinfection with calcium hypochlorite and formaldehyde, in which it was found that calcium hypochlorite gave no beneficial results and that formalin seemed promising, though its use seems prohibited on account of the expense.

Notes are given of pepper diseases due to Alternaria and Gloeosporium. Both of these fungi are able to attack young green fruits, and observations made in the field are said to indicate that defoliation of the plants by leaf-spot diseases is an important factor in causing sun scald and decay of fruits.

Plant diseases [Bermuda], E. J. WORTLEY (*Bermuda Bd. Agr. Rpt., 1916–1918, p. 26*).—Warm, moist southwest winds render local control of plant diseases difficult in Bermuda, especially as these conditions are often accompanied by washing rains which reduce the effectiveness of sprays.

Potato late blight (*Phytophthora infestans*) was very prevalent in 1918, causing much loss from the shipping of diseased potatoes. Early blight (*Macrosporium solani*) causes much damage in November and December.

Onions have suffered no serious outbreak of *Peronospora schleideniana* since 1914.

Beets often show *Cercospora beticola*, but seldom suffer severely from that fungus.

A serious cabbage disease noted in 1918 proved to be due to *Pseudomonas campestris*.

Celery losses have been serious during recent years from *Septoria petroselini*, but less so from *Cercospora apii*. Black heart (bacterial?) is the most serious celery disease in the colony.

Tomato interests are seriously affected by *S. lycopersici*, though removal of lower leaves and spraying with Bordeaux mixture checks that disease. *M. solani* has also been troublesome. *Cladosporium fulvum* is seldom seen.

Lettuce drop wilt (*Sclerotinia libertiana*) occasionally causes complete destruction of patches of lettuce. Leaf spot, due to an unknown organism, has been troublesome.

Annual report for 1919 of the botanist [on crop management and diseases], R. H. BIFFEN (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 407–411*).—While crop diseases were not particularly prevalent during the period covered by this report, wheat black rust caused considerable damage in certain districts, and potato wart disease showed in one locality. Immune varieties are discussed. Potato blackleg was noted on four occasions. Skin-spot was associated with cases of failure to sprout satisfactorily. Blight was less severe than usual. Alfalfa crown gall has become very common. Fruit fungus pests reported include peach leaf curl and mildew, apple and gooseberry mildews, apple brown rot and scab, and Botrytis on cherry. Silver leaf was noted on the Czar variety of plum. Apple glassy disease affected the two varieties Allington Pippin and Margil.

Mycology, F. J. F. SHAW (*India Bd. Sci. Advice Ann. Rpt., 1917–18, pp. 35–40*).—This report presents results of a study of ufra of rice (*Tylenchus angustus*), in which it is said that the nematode can be carried over by the seed from an infected crop. Movement of the organism from the water to the upper portions of the plant is favorably influenced by humidity (95 per cent), high temperatures, and light. Black band (*Diplodia corchori*) of jute (*Corchorus capsularis*) was discovered in different places. Black thread and leaf fall of rubber are decreased, but not economically, by removal of seeds and pruning for free admission of light and air.

Root rot of apple is caused by a Rosellinia, which is more severe in strongly acid soils. Cracking of apple fruits due to *Coniothecium chomatosporum* is very common in places. The advantage of spraying for peach leaf curl has been demonstrated. Die-back of chillies due to *Vermicularia capsici* is checked by spraying, also by late sowing on highly manured land. A blossom and twig rot is due to a fungus not previously known in India, *Choanephora cucurbitarum*. Root rot of sal causes few deaths as compared with the number of new attacks observed. Rangoon bean is severely damaged by a sclerotial fungus. *Erysiphe polygoni* is said to cause a serious disease of poppy. Peanut was attacked with unusual severity by a Cercospora (not *C. personata*).

It is shown that all parts above ground of *Hevea brasiliensis* may be attacked by *Phytophthora meadii*, which is considered different from *P. faberi*.

Paddy blast due to *Piricularia oryzae* has been found in one district. Smut (*Ustilago crameri*) on *Setaria italica* has been studied, and found to yield to a 0.5 per cent solution of copper sulphate. Tea brown blight (*Colletotrichum camelliae*) has been studied, and work on root disease of areca palms (*Fomes lucidus*) and the stamping out of koleroga (*Phytophthora arecae*) has been successfully continued. An account is noted of coffee black rot (*Corticium koleroga*).

[Studies on plant diseases] (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 17 (1919), pp. 6–17, figs. 2*).—Condensed accounts are given of tests and other studies regarding seed treatments for wheat stinking smut; breeding tests looking to the control of potato canker; *Coprinus* sp. on beet seed; and potato leaf roll.

Respiration of plants parasitized by fungi, G. NICOLAS (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 12, pp. 750–752*).—As a result of work following up that previously noted (E. S. R., 30, p. 453) by employing methods like those of Maquenne and Demoussy (E. S. R., 31, p. 33), the author reports that intensity of respiratory activity in parasitized as compared with that in nonparasitized plants was increased in case of endophytic and decreased in case of ectophytic parasites. The respiratory quotient of parasitized organs may be equal to or greater than that of nonparasitized organs.

The breeding of disease-resistant varieties of cultivated plants, E. Molz (*Ztschr. Pflanzenzücht., 5 (1917), No. 2, pp. 121–244, figs. 6*).—An extended account with discussion is given of observation and experimentation on the development and loss of resistance, of hybridization in relation to resistance, and of adaptation to hosts by parasitic organisms.

The action of rain on deposits from copper sprays, Mr. and Mrs. G. Villedieu (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 6, pp. 360–363*).—This is the first part of a project regarding the influence of rainfall on the retention and properties (effects) of fungicides employed in connection with plant disease.

The nontoxicity of copper for fungi, particularly downy mildew, Mr. and Mrs. G. Villedieu (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 737–739*).—Details of studies following those noted above are presented to show that copper is not more toxic to the Peronosporaceae than to other fungi. It appears possible to replace this metal in anticryptogamic sprays by one more readily obtainable.

Cereal smut and stripe disease, F. Aumüller (*Deut. Landw. Presse, 47 (1920), No. 54, pp. 383, 384*).—This is a statistical study of susceptibility or resistance as related to species and variety in cereals to smut and to stripe disease (*Helminthosporium gramineum*), and of effective concentrations in different fungicides appropriate to their control.

Barley stripe as a varietal disease, L. Kiessling (*Fühling's Landw. Ztg., 65 (1916), No. 23–24, pp. 537–549*).—This is a study of barley varieties, weather, and other factors in relation to stripe (*Helminthosporium gramineum*) and its control.

Varietal susceptibility of barley to stripe disease, L. Kiessling (*Ztschr. Pflanzenzücht., 5 (1917), No. 1, pp. 31–40*).—The results are tabulated with discussion of variety tests of barley as regards susceptibility to stripe disease (*Helminthosporium gramineum, Pleospora trichostoma*).

Oat anthracnose, W. Schikorra (*Centbl. Bakt. [etc.], 2. Abt., 45 (1916), No. 18–25, pp. 578–586*).—Discussion is given of data regarding the relation of oat dry spot to soils, including reactions and fertilizers.

Flag smut of wheat, V. A. Putterill (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 3, pp. 252–257, figs. 5*).—A general account of flag smut (*Urocystis tritici*) concludes with the statement that unless properly controlled it may become a very serious pest in South Africa.

How Iowa fights the injurious barberry, L. L. Rhodes (*Iowa Agr., 21 (1920), No. 2, pp. 65, 84, 86, 88, fig. 1*).—This contains a sketch of the history of the common barberry passing from Asia through Europe to America and spreading in portions of this country until knowledge of its connection with wheat rust (*Puccinia graminis*) led to the eradication campaign now in progress. Only three harmful species of barberry are known to exist in Iowa. These are the Amur barberry (*Berberis amurensis*), the common green leaf (*B. vulgaris*), and the purple leaf variety (*B. atro-purpurea*).

The results of estimates at six Iowa centers in 1919 give an average wheat crop loss of 5 per cent over the State of Iowa. Eradication methods are noted.

Treat seed grain, R. E. Vaughan and A. G. Johnson (*Wis. Agr. Col. Ext. Circ. 133 (1921), pp. 9, figs. 4*).—Directions are given for the treatment of seed grain for the prevention of smut, the methods suggested being those found by the Wisconsin Experiment Station to be satisfactory. The use of formaldehyde is recommended, and the two-hour soaking method has been found best for barley, proving successful for the control of stripe and covered smut of barley and greatly reducing loose smut. Five-minute soaking has proved best for oats, wheat, and rye. Where barrels or tanks are not available, sprinkling the

grain or applying a more concentrated solution of formaldehyde with a sprayer may be employed. Smut treating machines are on the market and it is stated that many of them are proving quite satisfactory.

Bean anthracnose, W. FISCHER (*Fühling's Landw. Ztg., 68 (1919), No. 13–14, pp. 241–259*).—The author notes a study of bean anthracnose (*Glocosporium lindemuthianum*) and of control measures attempted, including varietal and breeding tests.

Control of cruciferous club root, H. MÜLLER-THURGAU and A. OSTERWALDER (*Landw. Jahrb. Schweiz., 33 (1919), No. 1, pp. 1–22, figs. 7*).—An account of tests with different substances suggested for control of cruciferous club root (*Plasmodiophora brassicae*) shows very high effectiveness in case of Steiner's mixture and calcium hydrate, but lower effectiveness or none for several other preparations.

A study of the black and the yellow molds of ear corn, J. J. TAUBENHAUS (*Texas Sta. Bul. 270 (1920), pp. 3–38, figs. 10*).—The author presents the results of four years' study of the black and yellow molds of ear corn due to *Aspergillus niger* and *A. flavus*. The black mold is said to attack corn wherever openings have been made through the husk by the corn earworm, while the yellow mold in the field seldom invades more than one-third or less of the tip of the ear, and it is nearly always found on varieties with erect ears, which catch and hold water from rain or dew.

Inoculation experiments with the black mold on a large number of different host plants are considered to indicate that there are no physiological species or strains of *A. nigra*.

The author recommends the elimination of insect injury for the control of the black mold, and the planting of varieties of corn having pendant ears for the control of the yellow mold.

Both of these molds are also said to attack broom corn, and selections made at the station have shown that broom corn in which the length of the peduncle had been increased was less subject to the disease. These strains have also resulted in a better quality of broom corn.

Maize smut, E. NOFFRAY (*Jour. Agr. Prat., n. ser., 33 (1920), No. 20, pp. 367–369, figs. 2*).—A general account is given regarding propagation, transmission, development, and control of maize smut (*Ustilago maydis*) in the three kinds of maize commonly cultivated in France.

Controlling flax wilt by seed selection, E. C. STAKMAN, H. K. HAYES, O. S. AAMODT, and J. G. LEACH (*Jour. Amer. Soc. Agron., 2 (1919), No. 7, pp. 291–298, pl. 1*).—Reporting work begun in 1911, the authors state that it is possible by careful selection (preferably by the undivided plant method, which gives a more uniform product) to produce good crops of flax on heavily infected flax-sick soil. A seed-plat method is discussed as preferable. It is thought possible, by extensive adoption of plans discussed, to restore flax production eventually to the normal rate.

Susceptibility of Phaseolus vulgaris and P. multiflorus, G. LAKON (*Ztschr. Pflanzenkrank., 26 (1916), No. 2, pp. 83–97, figs. 5*).—An account is given of conditions, features, and effects of infection of *P. vulgaris* and *P. multiflorus* by *Uromyces appendiculatus* and other fungi, with a discussion of varietal differences and resistance.

Potato diseases in New Jersey, M. T. COOK and W. H. MARTIN (*New Jersey Stas. Circ. 122 (1921), pp. 39, figs. 22*).—Descriptions are given of the various diseases of potatoes which have been observed in New Jersey, with suggestions for their control so far as definite means are known. A report is given of spraying experiments which have been carried on for a number of years, the results indicating that spraying is advantageous whether there is a heavy in-

festation of disease or not. For the control of the scab and scurf, the author recommends seed treatment with corrosive sublimate or formaldehyde solution. In connection with the scab control, it is recommended that sulphur be applied to the soil to increase the acidity. Where a large proportion of the previous crop was rendered unsalable due to scab, the application of sulphur should be made at the rate of from 500 to 600 lbs. per acre. Where a less amount of scab is present, the application of sulphur should be reduced.

[Potato diseases], R. SCHANDER (*Fühling's Landw. Ztg., 67 (1918), No. 11–12, pp. 204–226, fig. 1*).—The author notes a study of the development of potatoes and of their diseases during the summer of 1917, in Posen and West Prussia as influenced by the unfavorable weather conditions then prevalent.

Report of professor of botany [Nova Scotia Agricultural College], H. W. SMITH (*Nova Scotia Sec. Agr. Ann. Rpt., 1919, pt. 1, pp. 63–66*).—The author states that large potatoes appear to be more frequently affected by late blight than are small tubers. Selection of small tubers for seed in the main crop caused no increase in the production of small tubers, though another experiment carried on for three years showed that selection of tubers weighing only 1 oz. as compared with tubers weighing 2 oz. gave a smaller yield each year.

Apparently potato scab in crops raised on infected areas was lessened by planting the seed tubers in soil treated with sulphuric acid or hydrochloric acid. The same was true in case of soil treated with swamp muck and acid phosphate.

Potatoes planted in ground on which straw had been burned were delayed 10 days in appearing above ground, but the yield was not decreased.

Degeneracy in potato, E. FOEX (*Jour. Agr. Prat., n. ser., 33 (1920), Nos. 16, pp. 275–279; 18, pp. 326–329; 19, pp. 344–346; 20, pp. 365–367*).—An account is given of the various agencies (diseases) associated with forms of degeneracy, chiefly in potato in different countries, as France, Holland, and the United States.

Potato wart disease in Britain, T. ANDERSON (*Potato Mag., 2 (1920), No. 8, pp. 8, 9, figs. 2*).—This is intended to be a brief but authoritative statement regarding potato-wart disease, as appearing at several points in Pennsylvania and at Thomas, a coal mining town, and Whitmer, a lumber camp, both in West Virginia. An account is given of the nature, spread, and control of the disease. Immune varieties are known in Great Britain, some of these being old established favorites.

Wart disease of potatoes (*Potato Mag., 2 (1920), No. 8, pp. 9–11, 34, figs. 4*).—This is Leaflet No. 11 of the Board of Agriculture for Scotland dealing with potato wart disease (*Synchytrium endobioticum*), which is said to be practically confined for the present to small private gardens and allotments. Discussion is given of the distinguishing features of the disease, its life history, and such practical considerations as precautionary and preventive measures and management of infected soil. The duration of infection when once established is not known.

Diseases, insects, and plant pests of the sugar cane in the Philippine Islands, C. W. HINES (*Philippine Agr. Rev., 11 (1918), No. 4, pp. 275–277, pls. 3*).—An account is given of observations on the Philippine pests and diseases of sugar cane, including insect and plant parasites.

Preliminary report on the spread of [sugar cane] gummosis, F. LEDEBOER (*Arch. Suikerindus. Nederland. Indië, 27 (1919), No. 18, pp. 956–961*).—The most important outcome of the comparative studies here outlined is said to be the proofs obtained that sugar cane gummosis is readily transmitted by the knife from diseased plants to sound cuttings.

The mosaic disease of sugar cane in Mississippi in 1920, L. E. MILES (*Mississippi Sta. Bul. 191 (1920), pp. 3–11, fig. 1*).—The sugar cane mosaic disease is said to have been found at only one point in Mississippi in 1919, but a survey of the State made in 1920 showed 34 properties located in 14 different counties to be infected with the mosaic disease. The location of the properties and percentage of infection are indicated.

For the control of this trouble the author recommends the roguing of the fields where mosaic disease occurs to the extent of 20 per cent or less. When a greater amount of infection is present, the grinding of the cane, destroying of all the refuse, and plowing up and destroying of the stubble are suggested, the ground to be planted during the next season to some crop not susceptible to this disease.

Sour rot in sugar cane cuttings, C. A. H. VON WOLZOGEN KÜHR (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 19, pp. 703–756, pls. 17, figs. 7; also Meded. Proefstat. Java-Suikerindus., Landbouwk. Ser., No. 3 (1920), pp. 54, pls. 17, figs. 7*).—Sour rot of cane cuttings, as here dealt with, is said to afford a starting point for the bacterial infection of the growing plant. The author points out the importance of starting with sound cuttings and favorable soil conditions to insure rapid growth.

The yellow-stripe [cane] disease, N. DEERR (*Facts About Sugar, 10 (1920), Nos. 10, pp. 190, 191; 11, pp. 210, 211; 12, pp. 232, 233*).—These installments constitute the author's report on the prevalence and nature of sugar cane yellow-stripe disease in Porto Rico, based on a first-hand survey which was made during December, 1919, and January, 1920, of conditions prevailing over a great part of the cane areas in Porto Rico. The account deals briefly with the history of the disease, the reasons for the difference between its behavior in Porto Rico and that in Java and Hawaii, the influence of precipitation, the clear differentiation between yellow stripe and the chlorosis due to root disease, and preliminary studies by Metz regarding the causation of yellow stripe.

The yellow-stripe disease appears to have been introduced from Argentina in 1914 on Japanese cane seedlings brought by way of Egypt, where the disease is now known to be prevalent. In parts of Porto Rico it has shown a high degree of virulence and has become fully established in nearly every part of the island. No significant relation was established between the disease and rainfall, ratooning, or root disease chlorosis, and evidence is referred to as recently obtained to the effect that the yellow-stripe disease in Porto Rico is due to an organism.

Apparently a considerable feature of the difficulty in control is the supposed occurrence of secondary infection, or the appearance of the disease in cane supposedly free from disease. Soil infection appears to have been eliminated from the probable causes. The agency of other hosts is suspected from the failure of control by rotations.

Control measures briefly discussed include seed selection, roguing, decrease of ratoonage, intermediate crops, destruction of rubbish, spraying, and the use of immune varieties, among which Kavangire (Uba)receives favorable mention.

Sugar cane stripe disease [in Java], P. VAN HARREVELD (*Arch. Suikerindus. Nederland. Indië, 27 (1919), No. 18, pp. 919–922*).—Sugar cane stripe disease is said to have shown unusual prevalence early in the season, this being true even in case of varieties usually showing low percentages of attack. The causal agent is not known.

Diseases of the sweet potato in Mississippi and their control, D. C. NEAL (*Mississippi Sta. Bul. 190 (1920), pp. 16, figs. 14*).—Descriptions are given of the diseases of sweet potatoes occurring in the field and also the storage rots as observed in Mississippi, with suggestions for their control. In connection with

the control of storage rots, the elimination of field diseases by control methods is recommended and it is suggested that potatoes be dug before frost, thoroughly dried, cured, and stored at suitable temperatures.

Tomato wilt, J. A. McClintock (*Georgia Sta. Bul. 138 (1920), pp. 37–49, figs. 5*).—The author reports tomato wilt, due to *Fusarium lycopersici*, widely spread in the coastal plain soils and becoming more serious in the Piedmont section of the State each year. The plants are generally of considerable size and are setting fruit when the first symptoms of the disease are manifest, and they usually die within a few weeks after the lower leaves begin to wilt. Attempts have been made by different investigators to develop strains of tomatoes resistant to wilt, but those adapted to one section of the country have not always proved adapted to other regions.

The author describes a method of growing tomato plants in containers of uninfested soil which it is thought may prove practicable for the home gardener who desires to raise only a few plants. The sterilization of the soil is effected by pouring boiling water through the containers at the rate of 7 gal. of water per cubic foot of soil. Investigations are said to have shown that the tomato wilt is not due to the same fungus which causes wilts of cotton, cowpeas, okra, and watermelons.

Brown [or black] rot in apples, H. Wormald (*Fruit, Flower, and Veg. Trades' Jour. [London], 38 (1920), No. 11, pp. 289, 291*).—The author instances the rapidity of growth of brown rot (*Monilia fructigena*) in apples as noted at Wye College in the summer of 1917, with a discussion of methods of overwintering and of control measures. An account is also given of stored apples affected with this fungus, which may show a black rot under certain conditions. The precise conditions producing brown rot in some cases and black rot in others have not been determined.

Brown rot of apricots and its prevention, W. L. Howard (*Better Fruit, 15 (1920), No. 1, p. 7*).—Apricot brown rot is said to have increased rapidly in California during the past five or six years, especially in the San Francisco Bay region and the coastal valleys. This disease does its chief damage in this region by attacking the flower clusters, then quickly killing the fruit spurs, and sometimes spreading to the wood, usually not over two years old. The disease may attack apricots and prunes when fully grown or nearly ripe. The chief protection, locally, against this disease is the dryness of June and early July. Peaches are protected in the same way during July and August, particularly in the interior valleys. Cold, wet weather at blooming time favors attack, as does also lowness of situation with attendant likelihood of frost injury.

As the result of trials with 17 or 18 different spray treatments at the Deciduous Fruit Station established in January, 1920, by the University of California at Mountain View in the Santa Clara Valley, it is believed that a single winter spraying with lime sulphur at winter strength, that is, 1 gal. of lime sulphur to 9 gal. of water, will control the disease, if given just as the trees are coming into bloom. Dry lime sulphur 12 lbs. in 50 gal. of water also gives good results. Bordeaux mixture at 4:5:50 was also effective. Other protective measures are briefly discussed.

Differences in Monilia cinerea on sweet and on sour cherries, K. Killian (*Jahresber. Ver. Angew. Bot., 15 (1917), No. 2, pp. 158–160, figs. 2*).—A study of *M. cinerea* on sweet and sour cherries and on other media is very briefly outlined.

The spraying of stone fruit orchards in the Cape Province, with special attention to red spider, F. W. Petty (*So. African Fruit Grower and Smallhold., 7 (1920), No. 10, pp. 303, 305*).—The most common diseases in the Western

Province are said to be leaf curl and rust of peach and shot-hole fungus disease of plum. These are described, as are also injuries due to insects in connection with treatments which are outlined.

Cranberry diseases and their control, C. L. SHEAR (*U. S. Dept. Agr., Farmers' Bul. 1081 (1920), pp. 22, figs. 13*).—Popular descriptions are given of the more common diseases of the cranberry, with suggestions for their control. Most of the fungus diseases, it is stated, can be prevented to a considerable extent by spraying with Bordeaux mixture. Among the diseases described are early rot (*Guignardia vaccinii*), bitter rot (*Glomerella cingulata vaccinii*), end rot (*Fusicoccum putrefaciens*), blotch rot (*Acanthorynchus vaccinii*), hard rot and tip blight (*Sclerotinia oxycocci*), red gall (*Synchytrium vaccinii*), rose bloom (*Exobasidium oxycocci*), red leaf spot (*Exobasidium vaccinii*), false blossom, black rot (*Ceuthospora lunata*), and rust (*Pucciniastrum myrtilli*).

Suggestions are given for the control of rot and spoilage during storage, shipping, and marketing. Proper methods and conditions of picking, storing, and handling of fruits, it is claimed, will largely control the storage rots. A description is given of a form of power sprayer that has been developed for the spraying of cranberry bushes.

Anthracnose or zwart roest of the grape, I. B. P. EVANS (*So. African Fruit Grower and Smallhold., 7 (1920), No. 8, p. 219, figs. 2*).—One of the most common and destructive diseases of grape in South Africa is that called anthracnose or zwart roest (*Glocosporium ampelophagum*), said to be identical with bird's-eye rot in America. Control measures include removal of diseased material and a hand-applied wash, prepared as indicated, of 25 lbs. iron sulphate and 1 pint sulphuric acid in 50 gal. of water. This is to be used on the dormant vines in winter, preferably at first at intervals of 15 days and later at 10 days, so long as considered necessary.

Peronospora parasitica, E. GÄUMANN (*Centbl. Bakt. [etc.], 2. Abt., 45 (1916), No. 18–25, pp. 575–577*).—Tabular data are given regarding the dimensions of conidia of *P. parasitica* as grown on different hosts.

Diseases of date in Morocco, E. FOEX and P. VAYSSIÈRE (*Jour. Agr. Trop., 19 (1919), No. 162, pp. 336–339*).—A discussion of two diseases of date, supposedly related but undetermined as to causation, concludes with suggestions as to treatment.

Disease of lime seedlings [in Montserrat], F. WATTS (*West Indies Imp. Dept. Agr. Montserrat Agr. Dept. Rpt., 1918–19, p. 40*).—In 1916, what appeared to be a new lime seed-bed disease resembling damping-off was observed. The apical portion of the plant was the first to show weakness in this case. The organism appeared to be one of the Peronosporaceae. Further observation has shown that young lime seedlings are invariably attacked by this disease, which is more accentuated in shaded situations. Bordeaux mixture checks the disease if applied on its first appearance.

A bacterial disease of ivy, G. ARNAUD (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 2, pp. 121, 122*).—The author describes the effects observed on English ivy in Paris in June, 1920, of an attack by an organism which is designated as *Bacterium hederae* n. sp. The symptoms are said to resemble strongly those produced on bean by *Pseudomonas phascoli* in America. Varieties are not equally susceptible. The disease appears to be favored by dampness.

The eelworm disease of the narcissus, J. K. RAMSBOTTOM (*Brit. Florists' Fed., Florists' Bul., 1 (1919), No. 1, pp. 11, 12*).—It is stated that nematodes can not withstand heat, as diseased bulbs soaked in hot water showed much less infection than untreated bulbs. This plan is still under investigation.

Gas poisoning in streetside trees, P. EHRENBERG and K. SCHULTZE (*Ztschr. Pflanzenkrank., 26 (1916), No. 2, pp. 65–83*).—A detailed account is given of

studies related to gas poisoning of trees following up those noted (E. S. R., 31, p. 730).

Further studies on deformation of oak leaves, ZADE (*Fühling's Landw. Ztg., 65 (1916), No. 23–24, pp. 549–559, fig. 1*).—This is a continuation, with tabular data and discussion, of studies previously noted (E. S. R., 33, p. 647).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The influence of man on animal life in Scotland.—A study in faunal evolution, J. RITCHIE (*Cambridge: Univ. Press, 1920, pp. XVI+550, pls. 9, figs. 91*).—Following the introduction, the several chapters of this work relate to the domestication of animals, deliberate destruction of animal life, protection of animal life, the deliberate introduction of new animals, the destruction of the forest, influences of cultivation and civilization, camp followers of commerce (animals introduced unawares), and chains of circumstance.

Report of entomologist, W. E. HINDS and F. L. THOMAS (*Alabama Col. Sta. Circ. 44 (1921), pp. 18–20*).—This report refers briefly to cotton dusting experiments for the boll weevil in 1920, the report covering which is noted above. The second generation of the fall army worm appeared the first part of July and did a tremendous amount of damage, especially to young corn, in 30 counties, chiefly on land that had been overflowed and under water for some time during the flooded conditions of December, 1919, and early spring of 1920. Reference is made to the appearance of the Mexican bean beetle (*Epilachna corrupta* Muls.), specimens of which were first received from the vicinity of Blocton and Birmingham in 1920. Reports on this pest by the senior author have been noted (E. S. R., 44, pp. 554, 751.)

[The rice bug and the rice leaf folder], G. BRIGGS (*Guam Sta. Rpt. 1919, p. 33*).—The rice bug (*Leptocorisa varicornis*) is said to have damaged late-maturing rice so badly that in several cases it was not harvested. The early-maturing strains of rice apparently escape a large part of the heavy infestation occurring from later broods of the rice bug. It was observed that rice on the experimental plats near cultivated fields was not damaged nearly so much as where grown near grass and brush land. The leaf folder was a source of considerable injury, especially to later plantings in the young stage. Its injury, caused by the folding of the leaves, results in a slow and very distorted growth.

Monthly notes on grubs and other cane pests, III, J. F. ILLINGWORTH (*Queensland Bur. Sugar Expt. Stas. Div. Ent. Bul. 10 (1920), pp. 39, figs. 3*).—This detailed report of work in progress from July, 1919, to July, 1920, is in continuation of reports previously noted (E. S. R., 42, p. 545).

The grape phylloxera in California, W. M. DAVIDSON and R. L. NOUGARET (*U. S. Dept. Agr. Bul. 903 (1921), pp. 128, pls. 11, figs. 10*).—This report deals with the history, injuries, and life history of the grape phylloxera in California, remedial measures having been left to be made the subject of another publication. The subject is dealt with under the headings: California history, accidental and natural spread, distribution of phylloxera in California, vineyard destruction, nomenclature and synonymy of the grape phylloxera, biology of the grape phylloxera in California, the radicicole, the nymph and winged form, nymphicals or intermediate forms, the sexual forms, the gallicole and its relation to California conditions, effects of water and heat on phylloxera, and diffusion of phylloxera, together with a summary and a list of the literature cited.

This pest must be known as *Phylloxera vitifoliæ* (Fitch), having been first described under that name in 1856 from the gall-inhabiting form, 12 years prior

to Planchon's description of the root-inhabiting form under the name *Rhyzaphis vastatrix*. The pest was introduced into California about 1858 on vines imported by settlers from the eastern part of the United States, where it is a native, or about the time it reached France, where the first evidence of its activity was vaguely noted in 1862. It has since spread throughout most of the grape districts of California wherever conditions have been suited for it, but has never assumed such disastrous proportions as it did during the first years of its ravages in France. It is estimated that since its appearance in California, or during a period of 60 years, it has destroyed about 75,000 acres of grapes. It has in many cases been distributed through the agency of infested rooted vines imported into uninfested districts or vineyards, while in other cases it has been carried on vineyard material. Its modified life cycle in California, that is, sterility of the winged form, coupled with topographic barriers, consisting of mountain chains and dividing valleys, has prevented the rapid distribution in the State which took place in the vineyard districts of France.

Vines attacked when young, before their rooting systems have become established, will succumb more rapidly than those infested at a later age. The first indication of its presence in a vineyard occurs in the form of one or more stunted vines and in the premature yellowing of the foliage. Gradually more and more of the surrounding vines are affected, and those first infested become very much weakened or die outright. Following the initial infestation of a vine under favorable conditions for phylloxera, the pest multiplies rapidly and within two or three years increases its range to involve the entire root system. The phylloxera which settle on the growing rootlets form fleshy lesions or swellings, termed nodosities. In a great majority of instances further apical growth of the rootlet is stopped, and the rootlet ceases to supply nourishment to the vine. Other phylloxerae settle on the older roots, and in most cases cause swellings termed tuberosities, which vary in size, the majority being about 0.2 in. in diameter. The bark of the root often cracks longitudinally, and a chain of swellings arises from phylloxera punctures. So long as these swellings remain fresh, the health of the vine is not much impaired, but as soon as they decay the vine is injured. When they decay in numbers the roots are frequently destroyed, causing first the stunting and then the death of the vine.

Its life cycle in California has been found to be much more simple than that which obtains in the eastern United States, and as far as the economy of the insect is concerned, is purely parthenogenetic. Winter is passed in the form of hibernant larvae, which are newly hatched larvae that settle down immediately after hatching from the egg in the autumn, although a few hibernate in an older stage. With the first flow of sap in spring these hibernants commence to feed, and mature on the average 5.5 weeks later. The mature hibernant does not differ from the adult radicicole of any other generation. On the average, it takes the hibernant 6 months to mature, the period ranging from 4.5 to 7.5 months. The mature hibernant gives rise to a number of generations—as many as eight—of root-feeding phylloxerae throughout the summer and autumn. Although somewhat arbitrary, April 15 to October 15 best indicates the period of the active half year of the insect, the period October 15 to April 15 being the dormant or hibernating season.

All forms of phylloxera are oviparous, the average number of eggs per adult radicicole being about 110 and the average egg-laying period about 45 days. Incubation varies from 5 days in midsummer to over 30 days in December. Larvæ hatching in the spring mostly settle near the egg shells, but in summer and autumn a considerable percentage travel along the roots or forsake the vine altogether for other vines. Four molts are passed by the larvae, and on

the completion of the final molt they become mature insects. The length of the developmental period varies according to food and meteorological conditions. On succulent living roots the average period of larval development was found to be about 22 days (hibernant generation excluded), and the maximum and minimum, respectively, 36 and 10 days.

The winged form is produced from the middle of June until November, it being more abundant in the coastal districts than in the interior valleys. In the first two instars the larvae of the winged form do not differ from the corresponding stages of the wingless form, but in the third and fourth stages they differ structurally, and in these stages are termed, respectively, prenymph and nymph. The nymphs have two pairs of grayish-black wing pads. The winged insect is orange in color with grayish-black head and thorax and two pairs of scantily veined wings.

"The nymphs transform in most instances near the surface of the soil, and the winged migrants issue on the surface and fly about in the vineyard and neighboring regions. The winged insects deposit eggs of two kinds, viz, male and female, and the insects which mature from these eggs are the true sexes. These forms are unable to take food, and under normal conditions mate upon reaching maturity, and the female forthwith deposits a single egg under the bark of the vine. This egg hatches in the spring and gives rise to a series of generations of gall-inhabiting and gall-making wingless aphids. A certain percentage of larvae born in the galls, however, migrate to the roots before taking food, and in this way the species returns to the soil.

"In California, under natural conditions, it is doubtful whether any sexes mature and still more doubtful whether any winter eggs hatch. Laboratory experiments indicate that the sexes mature in about 12 days.

"In the late autumn, along with the nymphs are found curious forms intermediate in appearance between adult radicicoles and nymphs. These are called intermediates or nymphicals. They are not abundant, and all those whose progeny have been observed were parthenogenetic.

"The diffusion of the phylloxera is effected in nature by the wandering newly hatched larvae of the radicicoles during summer and autumn. These pass from vine to vine, either on the surface of the soil or through subterranean cracks or pathways. They may also be borne by the wind or on vineyard material, such as picking boxes. Probably water is responsible for some diffusion in hilly or irrigated vineyards, and cultivating instruments, by picking up pieces of infested roots, may effect fresh infestations. The phylloxera is easily introduced into a vineyard or section by the practice of planting infested rooted vines to make up for cuttings which did not succeed in previous years."

A list is given of 23 references to the literature cited.

[Mosquitoes and disease transmission] (*Meded. Burgerl. Geneesk. Dienst Nederland. Indië, 1919, Nos. 1, pp. 84, pls. 10; 2, pp. 82, pls. 9, figs. 2; 3, pp. 88, pts. 8; 6, pp. 47, pls. 21; 7, pp. 39–85, pl. 1; 9, pp. 53–71, pls. 2+[addenda to 6], pp. 3, pls. 2; 10, pp. 168, pls. 32*).—The following papers relate to mosquitoes and to their rôle in the transmission of the causative agents of disease: No. 1, Report of a Journey for the Purpose of Studying Hygienic Conditions in the United States of North America, Panama, and Cuba, made by the Order of the Netherlands Minister for Colonial Affairs, by C. W. F. Winckel (pp. 1–84); No. 2, Malaria in Weltevreden and Batavia, by M. L. van Breemen (pp. 1–40), and Anophelines of West Java, by R. M. M. Mangkoewinoto (pp. 41–82); No. 3, The Susceptibility of Anophelines to Malarial Infections in Netherlands India, by N. H. Swellengrebel et al. (pp. 1–64), and On the Biology of *Myzomyia ludlowi* in Sumatra, by W. Schüffner et al. (pp. 65–88); No. 6, Description of the

Anopheline Larvae of Netherlands India, so far as They are Known Till Now, by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf (pp. 1–47; addenda, No. 9, pp. 3); No. 7, On the Requirements of Different Anophelines in Regard to the Abode of their Larvae, by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf (pp. 39–85); No. 9, Report on Experiments upon the Development of Malaria Parasites in some Anophelines, by N. H. Swellengrebel (pp. 53–71); and No. 10, *Myobium myzomyiae*, a Parasitic Haplosporidium Found in the Intestinal Tract of Some Anophelinae, by N. H. Swellengrebel (pp. 68–72), and Researches on the Anophelines at Some Stations of Java and Sumatra in Connection with the Occurrence of Malaria (pp. 1–67), Malaria in Modjowarno (pp. 73–112); and Report on the Occurrence of Malaria and Anophelines at Samarang (pp. 113–168), all by N. H. Swellengrebel and J. M. H. Swellengrebel de Graaf.

[Combating tobacco worms], G. Briggs (*Guam Sta. Rpt. 1919, pp. 34, 35*).—Tests made on four plats of 0.2 acre each showed the control of tobacco worms by spraying to be profitable. While the cost of hand worming was 40 cts. less per plat, the increased yield in the sprayed plats more than made up the difference.

The larger cornstalk borer in North Carolina, Diatraea zeacolella Dyar, R. W. Leiby (*N. C. Dept. Agr. Bul., 41 (1920), No. 13, pp. 85, figs. 27*).—This account is based upon a review of the literature and investigations commenced in 1915 and conducted continuously over a period of five years at the substations in Edgecombe and Pender Counties, supplemented with observations and breeding experiments at Raleigh. The investigations reported relate to the life history of the insect, a determination of the seasonal degree of infestation at several localities during each of the years, the causes of natural mortality, and the practical effectiveness of certain control measures, which were experimentally carried out following life history studies, for the purpose of reducing prevalent injuries.

The species is distinctly two brooded, one brood occurring in spring and early summer, known as the first brood, the other occurring in late summer, fall, and winter and known as the second brood. The winter is passed as a larva, about 0.75 in. long, in the taproot of the corn stubble. It becomes active early in the spring, and transformation to the pupal stage begins April 20, continuing to May 20, most of the larvae having pupated by May 10. The spring pupal stage occupies about 20 days, the moths beginning to emerge in small numbers about May 5 and the crest of the emergence period being reached from May 22 to 24. Oviposition commences within 48 hours after emergence from the pupae, and the moths live about a week.

The eggs are found in the field on early planted corn in small numbers about May 10. Most of them are deposited by May 25, but a few as late as June 5 by straggling adults. The incubation of the egg of the first brood requires a period of about 9 days. The larvae begin to appear about May 15 and are found in increasing numbers up to June 7, remaining at the high level until July 7, when some begin to transform to pupae. The length of the larval stage varies considerably but approximates 35 days, during which time the larvae have fed within the "throat" of the corn and tunneled in the cornstalk. Transformation to the pupal stage, which takes place within the tunnel of the stalk, begins about July 7, with most of the larvae pupated by July 25. The duration of the pupal stage of this brood is about 12 days.

The moths of the second brood are present in the field in maximum numbers about July 31, and eggs are deposited on corn beginning 2 days after emergence and continuing for about 3 days. The incubation period of the eggs of the second brood is about 7.8 days. The larvæ again attack the corn by feeding

in the "throat" of corn planted late, or tunneling in the stalk of early planted corn. As the larvae become grown and the cornstalks become dry, the larvae work downward and bore in the taproot, this happening in October. Here a tunnel is made and a chamber cleaned out where the insect passes the winter as a fully grown white robust larva.

No parasites have been reared from the larvae, but two hymenopterous species have been reared from the pupae. The egg parasite, *Trichogramma minutum* Riley, is by far the most common parasite of the borer in North Carolina. A very high percentage of the winter mortality of hibernating larvae is caused by two fungus parasites.

Control measures recommended include a delay in corn planting until May 25 or later, so that the corn will not be attacked by the first brood of larvae. Such corn will make a good growth by July 20, when the second brood of larvae will begin its work; but it will not be seriously injured by the second brood, even though a high percentage of the stalks may be infested. Disturbing the stubble in the fall by plowing it out (laying it on the ground) or by general plowing in the field causes 85 to 95 per cent of the larvae to die during the winter, or 25 to 50 per cent more than would normally die. It is stated that a combination of these two control measures, if practiced over a period of one or two years, will reduce stalk-borer injury to the minimum, if not locally eradicate it. The plowing of stubble land as early as possible before May 15, followed by harrowing, burning of the stalks and stubble during the winter or early spring, and rotation are recommended.

A bibliography of 19 titles is included.

Studies in the biology of the Mexican cotton boll weevil on short-staple upland, long-staple upland, and Sea Island cottons, G. D. Smith (*U. S. Dept. Agr. Bul. 926 (1921), pp. 44, pl. 1, figs. 18*).—This is a report of studies conducted at Madison, Fla., during the years 1918 and 1919, in which a short-staple upland cotton known as King, a long-staple variety known as Webber No. 49, and a Sea Island cotton known as Hope Straight were used. The data, which are reported in large part in tabular form, have led to the following summary and conclusions:

"At Madison, Fla., the average longevity of hibernated weevils without food was 12.7 days, and 18.8 days when fed on cotton plantlets. Adult weevils of the first and second generations lived 24.3 days on cotton squares and 12.3 days on cotton bolls. On Sea Island cotton plantlets the hibernated weevils lived 11.05 days. The first and second generation weevils fed on Sea Island cotton squares lived 10.7 days, while the weevils fed on Sea Island cotton bolls lived only 15.3 days. There is practically no difference in the longevity of boll weevils on Sea Island and upland cottons.

"The average period from the time the weevils become adult to oviposition at Madison, for all experiments, was 8.9 days for weevils bred under insectary conditions and 7.07 days for weevils bred under field conditions. The average period of oviposition under insectary conditions for all weevils under observation on upland cotton was 33.1 days. The entire series deposited eggs over an average period of 31.7 days on Sea Island cotton. The largest number of eggs deposited by a single female weevil was 432. This record was made by a hibernated female on upland cotton squares under insectary conditions. The largest number of eggs deposited during any one day under insectary conditions was 25. This record was also made by a hibernated female weevil.

"The average period from oviposition to adult of all weevils bred under insectary conditions on upland cotton squares was 14.91 days. On Sea Island cotton the average period from egg to adult for all weevils bred under insectary conditions was 14.94 days. The field-bred weevils showed more vitality than

weevils bred under artificial conditions. Under field conditions the average length of time the infested squares hung on the upland cotton plants after egg puncture was 11.5 days. The time required to complete the development of the immature weevil after the infested square dropped to the ground was 10.8 days in upland cotton squares.

"There was practically no difference shown in the length of the developmental period of the boll weevils bred in short-staple upland, long-staple upland, and Sea Island cotton squares. The developmental period of the boll weevil was approximately 7.5 days longer under field conditions than under insectary conditions at Madison, Fla. Soil temperatures of 120° F. and higher are usually fatal to the immature weevils under field conditions.

"The boll weevil at Madison, Fla., shows a decided tendency to form a new variety. The hibernation of the weevil at Madison is incomplete, and the adults are seldom inactive more than 30 days at a time.

"The emergence from hibernation of the weevil in Florida is very gradual, the total daily emergence bearing a direct relation to the total daily rainfall. Weevils survived the winter in larger numbers in cages set on the ground in the woods than in the open field or in cages in trees 10 ft. above ground. Weevils placed in hibernation cages on November 15 survived in larger numbers than on any other date of installation. The percentage of total emergence from hibernation begins with more acceleration in Florida than in Texas up to the time that 25 per cent emerges. After 25 per cent of the weevils have emerged in Florida the emergence is less rapid, and the Florida emergence curve very closely approaches the emergence curve for Louisiana. The total percentage of hibernating weevils that survived the winter of 1918–19 at Madison was 7.54."

Poisoning the boll weevil, W. E. Hinds and F. L. Thomas (*Alabama Col. Sta. Bul. 212 (1920), pp. 53–84, fig. 1*).—The first part of this bulletin (pp. 53–77), relating to dusting experiments conducted during the years 1918 and 1919 and presented in large part in tabular form, has been summarized in an account previously noted (E. S. R., 43, p. 561).

Part 2 (pp. 78–84) presents a summary of the results of the dusting work continued during the year 1920, the details relating to which were destroyed when the laboratory building was burned in the fall of that year. A traction-machine-dusted plat of 3 acres, with 1.5 acres check, on which applications were made July 29 and August 3, 7, and 21, at the average rate of 7 lbs. per acre of calcium arsenate, gave an average yield of 1,260 lbs. of seed cotton per acre from the dusted and 888 lbs. per acre from the check plat. Figuring the value of the increase in yield at 6.5 cts. per pound of seed cotton, it amounted to an increase of $24.18 per acre, and upon deducting the cost of treatment, $8.16 per acre, there was a margin of $16 profit per acre.

On another plat of 5 acres on the same plantation, with less fertile soil, where three dustings were applied, the third being washed off by heavy rains, the yield averaged 678 lbs. seed cotton per acre, while the check gave 596 lbs. While there was an apparent loss of 32 cts. per acre, the infestation of the treated area was higher than that of the check, being on August 3d 20 per cent as against 12.7 per cent. The yield on treated cotton was increased about 14 per cent, thus actually paying a small profit.

On a 30-acre tract of fine sandy loam at Geneva, which was given four applications between July 6 and August 10, the results were deemed very satisfactory and profitable.

The 2-wheeled, traction-driven type of machines operated by one man, which was manufactured by several companies and placed on the market in 1920, almost entirely superseded the gas-engine-driven type of duster, and demon-

strated its practicability, reliability, and economy of operation in spite of minor weaknesses which developed under field use.

In conclusion, it is pointed out that weather conditions will always affect the dusting problem. Appearances thus far in Alabama indicate that every effort should be made to continue dusting at the usual 4- or 5-day intervals in spite of threatening weather during periods of frequent rains. If, however, the weather is sufficiently hot and dry for a period of more than a month, and especially during the first part of the fruiting season, the weevils may be controlled thereby so fully that dusting will not be needed or will not pay.

Parasitism by Aphiochaeta (Phora) fasciata Fallen, J.-L. LICHTENSTEIN (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 9, pp. 531–534, figs. 3*).—The author finds *A. fasciata* to be a true parasite of the nymphs of Coccinellidae. The female invariably oviposits on nymphs, always waiting until the last stage. The eggs are deposited externally on the host, and several may be placed on the same nymph. The larva emerges in 1.5 or 2 days and penetrates the host, not more than three or four being able to complete their development in a nymph.

Winter treatment for honeybees, C. E. SANBORN (*Oklahoma Sta. Circ. 48 (1920), pp. 4, figs. 3*).—This is a brief popular account, summarizing the proper procedure and including the method of wrapping the hive.

FOODS—HUMAN NUTRITION.

[Some papers on nutrition and health] (*Commonhealth [Mass. Dept. Pub. Health], 7 (1920), No. 4, pp. 203–281, figs. 10*).—This contains a bibliography on school lunches, two short plays suitable for children, and a number of papers, including The Development of Nutrition Activities by the Massachusetts Department of Public Health, by E. R. Kelley; A Nutritional Program for Massachusetts, by M. Champion; Nutrition Work in the Schools of New York State, by M. G. McCormick; Malnutrition, by L. H. Gillett; Nutrition of Children, by F. B. Talbot; Food Accessory Factors in Relation to the Teeth and Bones, by P. R. Howe; Bodily Mechanics: Its Relation to Nutritional Disorders, by L. T. Brown; The Training of Women for Health Work in Nutrition, by A. Blood; A Food Center as a Part of the Board of Health, by R. G. Hopkins, E. A. Harvey, and E. P. Lewis; and Hot Lunches in Our Schools, by L. Comstock.

Some famine foods in Ahamedabad, G. P. PATHAK (*Agr. Jour. India, 15 (1920), No. 1, pp. 40–44*).—Some information regarding the nature, preparation, and food value of a number of articles is given, including the rhizomes of two sedges (*Scirpus kysoar* and *Carex bulbosus*), the inflorescense of *Typha angustata*, and the tubers of a water lily (*Nymphea stillata*).

Relation of grade, class, and originating point of wheat to volume of bread baked from flour made therefrom, S. J. LAWELLIN (*Jour. Amer. Assoc. Cereal Chem., 6 (1921), No. 1, pp. 7–10*).—Details of baking tests are reported and discussed. In the author's opinion, work of this sort is quite valuable in judging wheat.

Chemical control in the bakery, R. W. MITCHELL (*Jour. Amer. Assoc. Cereal Chem., 6 (1921), No. 1, pp. 11–13*).—A discussion of commercial bread-making problem with special relation to chemistry.

On the preservation of the antiscorbutic properties of cabbage by drying, A. HOLST and T. FRÖLICH (*Jour. Trop. Med. and Hyg. [London], 23 (1920), No. 21, pp. 261–263*).—The authors have extended their previous studies on the antiscorbutic properties of cabbage (E. S. R., 27, p. 567) by an investigation of the effect of various methods of treatment after preliminary drying.

Slices of cabbage dried for one week in an incubator at 37° C., further dehydrated in the incubator by the action of phosphorus pentoxid, and then placed in vacuum bottles and stored at the same temperature showed very pronounced antiscorbutic properties after from 18 to 26 months. Cabbage dried at 37° but not treated with phosphorus pentoxid lost most of its antiscorbutic properties when kept for 18 months at 37° in closed vessels with calcium chlorid, but retained its properties to a certain extent when kept at from 4 to 12°. Samples kept at 4° in closed vessels without being previously dried showed moderate antiscorbutic properties at the end of 18 months.

Fat-soluble content of oils, A. D. STAMMERS (*Brit. Med. Jour., No. 3128 (1920), pp. 919, 920*).—Attention is called to the necessity, in reporting the presence or absence of fat-soluble A in oils, of giving the history of the sample used with the processes through which it has passed.

Digestibility of some hydrogenated oils, A. D. HOLMES and H. J. DEUEL, JR. (*Amer. Jour. Physiol., 54 (1921), No. 3, pp. 479–488*).—The digestibility of cottonseed, peanut, and corn oils partially hydrogenated to give hardened oils of different melting points was determined by the methods employed in previous studies from the Office of Home Economics, U. S. Department of Agriculture (E. S. R., 42, p. 552).

None of the oils caused any observable digestive disturbances or decreased the digestibility of the experimental diet as a whole. Although the coefficient of digestibility decreased as the melting point of the fat increased, all of the oils with the exception of the sample of peanut oil melting at 52.4° C. and of corn oil melting at 50° were 92 per cent or more digested. The highest coefficient of digestibility obtained was with a hardened peanut oil melting at 37°, which gave a percentage digestibility of 98.1. The authors conclude that these hydrogenated oils are as well utilized as natural fats of corresponding melting points.

The control and manufacture of saccharin, O. BEYER (*Ueber die Kontrolle und Herstellung von Saccharin. Zurich: Rascher & Co., 1918, pp. 141, figs. 12*).—This is a collection of information on the manufacture, properties, determinations, uses, and physiological effects of saccharin and its by-products. An extensive list of references to the literature on saccharin, including patent literature, is appended.

Comparison of the bacterial counts from machine and hand washed dishes and their significance, R. S. DEARSTYNE (*Amer. Jour. Pub. Health, 10 (1920), No. 11, pp. 871–873, fig. 1*).—Tabulations are given of the bacterial counts obtained from the eating utensils at restaurants where various methods of cleaning the dishes were used. The data show a very much higher bacterial count in hand-washed than in machine-washed dishes.

Adsorption of cyanid gas by foodstuffs (*Pub. Health Rpts. [U. S.], 35 (1920), No. 27, p. 1597*).—The question of the possibility of adsorption of cyanid gas by foodstuffs exposed in the process of fumigation of vessels, warehouses, etc., was tested by exposing bread and milk to the gas under a bell jar for from 2 to 22 hours and then feeding it to white mice (with or without preliminary exposure to air).

With excessive amounts of the cyanid, death followed the ingestion of the bread and milk if taken immediately after the removal of the bell jar. If allowed to stand for some time, no ill results were noted. This is thought to indicate that the possibility of poisoning occurring from the consumption of food materials exposed to cyanid gas is very slight.

Red Cross course in food selection (*Washington, D. C.: Amer. Red Cross, 1921, pp. 100*).—The material included in this pamphlet, though written primarily for Red Cross classes in food selection, can be used by women interested in

the problems of feeding the family. The lessons, 15 in number, deal with factors which must be considered in selecting an adequate diet, and the course, as a whole, aims to give a knowledge of foods and food groups, and so enable the housekeeper to modify her selection of food to suit the needs of the individual members of the family.

The matter of food selection for rational life is very much simplified for teaching purposes by following the convention of dividing the food supply into five groups, and recommending that all groups be well represented in the diet. The groups are (1) vegetables and fruits; (2) foods rich in protein; (3) cereals and cereal products; (4) sugars and other sweets; and (5) fats and fatty foods. A special lesson is devoted to milk. Fruit and beverages are also considered, as well as calculations on the food value and the cost of the diet; infant feeding and food for the child; and feeding in special cases.

In the preparation of this publication the Office of Home Economics of the U. S. Department of Agriculture and a number of individuals cooperated with the Red Cross.

The question of correct diet, M. Greig (*Nat. Hist., 20 (1920), No. 5, pp. 587–591, figs. 3*).—A traveling exhibit designed to illustrate correct principles of diet, prepared by the New York City Department of Education in cooperation with the American Museum of Natural History, is described, and examples are given of meals so made up that they provide a healthful diet for a child from 10 to 13 years of age. The exhibit includes 16 wax models of foods, eight wall charts, and a set of colored blocks showing the composition of six common foods.

The contribution of European experience on low diets to our teaching of dietetics, A. F. Morgan (*Jour. Home Econ., 13 (1921), Nos. 2, pp. 49–53; 4, 157–168*).—Much information (some of it not readily accessible) is summarized and discussed with reference to the effects of low diet during the war and after it.

The food of the immigrant in relation to health, M. M. Davis, jr. and B. M. Wood (*Jour. Home Econ., 13 (1921), Nos. 1, pp. 19–25; 2, pp. 66–74*).—The authors have summarized much useful information regarding the diet of immigrants, and ways are suggested for teaching them how to make wise and rational use of American foods and in general to adapt themselves to American ways of housekeeping.

Diet for the school child, L. H. Gillett (*U. S. Bur. Ed., Health Ed. No. 2 (1919), pp. 1–14, figs. 10*).—This discussion of food in relation to health is designed particularly to interest and instruct children. The text is followed by sample menus for children from 7 to 12 years of age in summer and in winter.

The lunch hour at school, K. A. Fisher (*U. S. Bur. Ed., Health Ed. No. 7 (1920), pp. 3–62*).—Various school lunch problems are discussed, including school lunches and health education, special nutrition work for undernourished children, the social aspects of the school lunch, supplying lunches to poorer children, school lunches in rural schools, lunches in high and normal schools, the elementary school lunch, the hot lunch in consolidated schools, equipment for school lunch rooms, business methods, and related topics. Some selected recipes are included, as well as a list of references.

Malnutrition and school lunches in the elementary schools of Chicago, L. E. Blauch ([*Ill.*] *Inst. Quart., 11 (1920), No. 4, pp. 111–118*).—In addition to some historical and other general data, information is summarized regarding the elementary school lunch work in Chicago.

Calcium in the blood of children, W. Denis and F. B. Talbot (*Amer. Jour. Diseases Children, 21 (1921), No. 1, pp. 29–37*).—The results are reported and discussed of a series of calcium determinations on the blood of 119 children of

unselected hospital cases of different disorders. Calcium was determined by the Lyman method (E. S. R., 37, p. 207), modified by the use of citrated plasma instead of whole blood and three calcium standards for comparison instead of one.

The extreme range of calcium in these cases was from a minimum of 1 mg. per 100 cc. of blood plasma to a maximum of 13.5 mg. Although the calcium values of the blood of 28 cases of rickets were in general distinctly below normal, the authors are of the opinion that too great significance can not be attached to these results, as several of the patients were also suffering from other maladies (pneumonia predominating) which might affect the calcium level in the blood.

In a number of these cases magnesium determinations were also made by the method of Denis, previously noted (E. S. R., 42, p. 712).

Zinc in the human organism, S. Giaya (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 15, pp. 906–909*).—Determinations of zinc in human viscera are reported which confirm the conclusions of Ghigliotto (E. S. R., 41, p. 465) and of Rost and Weitzel (E. S. R., 42, p. 758) that zinc is a normal constituent of the human body. The study of the distribution in different organs showed its presence in decreasing amounts in the following order: Brains, lungs, stomach, liver, kidneys, intestines, heart, and spleen. The urine contained very little (0.00017 gm. per liter), while human milk contained about 0.0013 gm. per liter. In the viscera examined the amount of zinc was found to increase with the age of the subject. This is thought to be due to a gradual accumulation in the system of small quantities ingested with the food.

The presence of creatinin and creatin in the blood in normal and pathological conditions.—IV. Revision of former methods and results. A comparison of methods, J. Feigl (*Biochem. Ztschr., 105 (1920), No. 4–6, pp. 255–281*).—This paper, which is in continuation of previous studies (E. S. R., 40, p. 765), consists in a discussion and comparison of the results obtained in the use of recent modifications of methods of determining creatin and creatinin. The author is of the opinion that the values obtained for creatin under present conditions are of little significance, while preformed creatin is the variable factor in pathological conditions.

The pigments of the adrenals, G. M. Findlay (*Jour. Path. and Bact., 23 (1920), No. 4, pp. 482–489*).—Recent studies on the lipochrome pigments of the animal body and their derivation from vegetable tissues are reviewed, and a study is reported of the pigments of the human adrenals in normal and pathological cases and of the adrenals of hens on different diets. Tests used in distinguishing xanthophyll, carotin, and melanin are described, solubility in petroleum ether being used to differentiate carotin from xanthophyll, and the blue coloration with Nile-blue sulphate to distinguish lipochrome granules from melanin, which gives a green color with the same reagent.

A decrease in the lipochrome of the adrenals of hens on a diet of polished rice and a marked increase on a diet of yellow corn and oats is thought to indicate that the amount of lipochrome may be varied at will by alterations in the lipochrome content of the food. That the decrease in lipochrome on a diet of polished rice is not due to lack of water-soluble B is considered proved by the fact that in man beriberi can develop even when the food contains a normal supply of lipochrome pigment.

The study of normal human adrenals obtained in cases of accidental death showed that there are present in the adrenals under normal conditions at least two lipochrome pigments, one of which is soluble (carotin) and the other insoluble (xanthophyll) in petroleum ether. Melanin pigment was also demonstrated in the first months of extra-uterine life and in old age.

In pathological conditions of an acute character the amount of lipochrome pigment in the adrenals was generally increased, while no melanin pigment was found. In chronic diseases there was not only a considerable increase in lipochrome, but melanin was found to be present in both the cortical and in the medullary cells.

Further studies on intestinal implantation of Bacillus acidophilus, H. A. CHEPLIN and L. F. RETTGER (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 1, pp. 30–32*).—The conclusions drawn from earlier observations on the intestinal implantation of *B. acidophilus* (E. S. R., 43, p. 769) are confirmed, and the preparation and properties of *B. acidophilus* milk are briefly described.

Changes in organ weight produced by diets deficient in antiscorbutic vitamin, V. K. LAMER and H. L. CAMPBELL (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 1, p. 32*).—The authors report that in young guinea pigs fed on a diet deficient in water-soluble C the adrenals at autopsy show a definite increase in size over the normal and a still more marked increase in weight, at times approximating 100 per cent when computed on the basis of body weight minus alimentary canal. The increase in weight of the adrenals was proportional to the length of time the animal was on the scorbutic diet, and was particularly pronounced in animals which had been kept alive for a longer period by the administration of small but insufficient amounts of orange juice.

"This may be interpreted as indicating a compensatory response to the decreased adrenalin production known to exist in the scorbutic animal. This point is of interest in connection with the extensive intramuscular and intestinal hemorrhages found in scurvy."

No evidence was obtained that the liver is affected by a lack of water-soluble C alone, although there was some indication that the heart and kidneys are enlarged on the scorbutic diets.

Protein and carbohydrate equivalents in the diabetic dietary, E. M. EWING (*Jour. Amer. Med. Assoc., 76 (1921), No. 5, pp. 300, 301*).—A diet list for diabetics is presented in which the foods are divided into four groups, the first three predominating, respectively, in protein, carbohydrate, and fat, and the fourth consisting of miscellaneous articles to be added to the dietary without allowing for food value, such as coffee, washed bran, etc.

In the protein group the weight of each article of food is such as to furnish 6 gm. of protein, this amount being chosen on account of its being the average protein content of eggs, certain diabetic muffins, etc. Each of the carbohydrate portions furnishes 5 gm. of carbohydrate. The portions of fat have not been made equivalent, but represent convenient amounts. With each food in every list is given the amount in grams of protein, fat, and carbohydrate furnished, from which the total calorific value can be readily calculated.

The prevention of diabetes mellitus, E. P. JOSLIN (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 79–84*).—This is essentially a discussion of the relation of obesity to diabetes.

Recent work on pellagra, C. VOEGTLIN (*Pub. Health Rpts. [U. S.], 35 (1920), No. 25, pp. 1435–1452, fig. 1*).—In this paper, read before the Harvey Society of New York on January 24, 1920, the author summarizes the work that has been done by the U. S. Public Health Service and by other investigators in the attempt to explain the origin of pellagra. The conclusion is drawn that diet is the essential factor in the production and cure of the disease, and that while the nature of the dietary defect has not been discovered, observations point to a combined deficiency in some of the well recognized dietary factors as the cause of the pellagrous syndrome. An extensive list of literature references is appended.

A study of the leucocyte changes in pellagra compared with those occurring in beriberi, G. M. FINDLAY (*Jour. Path. and Bact., 23 (1920), No. 4, pp. 490–498*).—Determinations are reported of the leucocyte changes in pellagra, as determined by comparison of the blood findings in a number of cases of uncomplicated pellagra with those of healthy controls on the same diet. The data on pellagra cases are then compared with similar data from cases of beriberi, with the following conclusions:

"In pellagra there is a slight increase in the total, but a decrease in the percentage, neutrophil count. In beriberi there is a decrease in the total, but not in the percentage, neutrophil count.

"In pellagra there is an increase both in the total and percentage, lymphocyte count. In beriberi there is a decrease in the total, but not in the percentage, lymphocyte count."

A consideration of the gastric test meal from experimental data, M. E. REHFUSS and P. B. HAWK (*Jour. Amer. Med. Assoc., 75 (1920), No. 7, pp. 449–452*).—This is a brief discussion of gastric analysis and its interpretation, based largely on the studies from the authors' laboratory previously noted (E. S. R., 44, p. 665).

A simple device for measuring basal metabolism, H. M. JONES (*Jour. Amer. Med. Assoc., 75 (1920), No. 8, pp. 538, 539, figs. 2*).—A brief description with accompanying photograph and diagram is given of a portable respiration apparatus which is said to have the advantages over the Benedict apparatus of being actually portable, requiring no electrical connection for operation, and involving no mathematical calculations.

Basal metabolism determinations.—Tests with two portable closed-circuit respiration apparatus, H. N. TIHEN (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 86–88*).—A comparison of the Benedict apparatus for determining basal metabolism and the Jones apparatus noted above was made by duplicate determinations with each apparatus on 20 different subjects.

The average percentage variation between the two readings with the Benedict apparatus was 3.5 per cent and with the Jones 3.7 per cent, while the average difference in variations of determinations with the two sets of apparatus was 3.9 per cent. Five successive determinations on one patient with the Jones apparatus resulted in a maximum variation of slightly less than 4 per cent, while with five determinations on a normal subject a maximum variation of 3 per cent was obtained.

The author concludes that suitable clinical accuracy can be obtained with either apparatus, but that the Jones apparatus, "because of its compactness, relative simplicity, and accuracy, is especially valuable for clinical use."

The determination of the basal metabolic rate, and its value in diseases of the thyroid gland, C. M. and D. WILSON (*Lancet [London], 1920, II, No. 21, pp. 1042–1045*).—This is a discussion of the method of determining basal metabolism by indirect calorimetry and the value of this determination to clinicians in diagnosing diseases of the thyroid gland.

The fundamental classification of disease by the basal metabolic rate, W. M. BOOTHBY (*Jour. Amer. Med. Assoc., 76 (1921), No. 2, pp. 84–86*).—The author discusses the significance of the basal metabolic rate in the diagnosis of disease, pointing out that as the clinical thermometer divides diseases into the febrile and afebrile groups, the basal metabolic rates differentiate diseases into three distinct groups, those with normal, increased, and decreased basal metabolic rates. While a very high percentage of all abnormal basal metabolic rates are dependent on or accompanied by an altered function of the thyroid gland, the rate is shown to have a greater significance than as a test for hypo- or hyperthyroidism.

"The 'normal' standard of the basal metabolic rate is not exact, yet the comparatively small 'normal' variation, compared to the wide range of pathologic variation, admits of fully as accurate grouping of diseases as does the body temperature. It is to be hoped that the value of basal metabolic rates will not be discredited by carelessness in technique and a failure to appreciate the necessity for carrying out all the technical and physiologic details requisite for obtaining accurate basal metabolic rates."

ANIMAL PRODUCTION.

The mammary apparatus of the Mammalia, E. BRESSLAU (*London: Methuen & Co., Ltd., 1920, pp. VII+145, figs. 47*).—This volume consists of three chapters dealing with the structure and development of the mammary glands in monotremes, marsupials, and placental mammals, respectively. The author's main interest is in the phylogenetic history of the Mammalia. There is a bibliography of about 45 titles, none later than 1911.

Studies on the mammary gland.—VI, The development of the mammary gland from its earliest appearance until the period of pregnancy, J. A. MYERS (*Amer. Jour. Diseases Children, 18 (1919), No. 1, pp. 4–13*).—This paper is essentially a summary of the author's observations on the mammary gland of the rat reported in his earlier studies (E. S. R., 42, p. 667) and a survey of relevant literature on other species of mammals, including man.

The development of the secretory ducts of the mammary gland.—Researches on cattle, M. ZSCHOKKE (*Arch. Mikros. Anat., 93 (1919), No. 2–3, I, pp. 184–209, pl. 1, fig. 1*).—The author's material consisted of histological preparations of the mammary glands of 30 bovine fetuses and 3 young heifer calves, and he describes the development of the primary and secondary ducts, the milk cistern and teats, and the histological differentiation of the gland tissues. There is a bibliography of 66 titles.

Composition of the bovine at birth, L. D. HAIGH, C. R. MOULTON, and P. F. TROWBRIDGE (*Missouri Sta. Research Bul. 38 (1920), pp. 3–47, pl. 1*).—Seven Jersey fetuses and young calves and 13 Hereford new-born calves were used in this study. There were three groups of Hereford calves produced by dams that had been, respectively, on high, medium, and low planes of nutrition during gestation. The Jersey calves did not form an experimental group, as some were the products of abortion and some others were born dead. In general, data from only two calves are included in the Jersey averages. Tables give for each calf, with certain incidental exceptions, the weights of the blood, hair and hide, composite flesh, 23 internal organs, skeleton, excreta, and kidney fat, and the chemical composition of the blood, liver, nervous system, total internal organs, hide and skin, skeleton, flesh, bone marrow, kidney fat, intestinal contents, and the entire animal. The following are the average of the analyses of the calves, the flesh, and the skeleton for each breed and group:

Chemical composition of new-born calves.

Breed of calves and nutrition plane of dams.	Entire calf.					Composite flesh.				Skeleton.				
	Water.	Fat.	Nitrogen.	Ash.	Phosphorus.	Water.	Fat.	Nitrogen.	Ash.	Water.	Fat.	Nitrogen.	Ash.	Phosphorus.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Hereford:														
High plane...	72.4	4.15	3.00	4.15	0.805	76.3	4.41	2.79	0.984	64.3	3.97	2.88	12.81	2.60
Medium plane.....	72.5	3.57	2.97	4.51	.809	76.5	4.07	2.77	.988	65.0	3.36	2.85	13.18	2.51
Low plane...	73.6	3.24	2.81	4.91	.915	78.2	3.62	2.57	.993	65.4	3.03	2.78	13.57	2.67
Average of all.....	72.8	3.65	2.93	4.52	.841	77.0	4.01	2.71	.989	64.9	3.45	2.83	13.19	2.59
Jersey.....	73.4	3.82	2.88	4.15	.681	77.4	3.12	3.19	.974	63.0	2.18	3.21	13.83	2.43

The stomachs and intestines of the Jersey calves were heavier in proportion to body weight than those of the Herefords and the small intestines were longer. The Herefords also had heavier hides, but otherwise there were no distinctive breed differences noted.

Most of the fat in these calves was found with the internal organs. Attention is called to the fact that the sums of the percentages of fat and water tend toward a characteristic constant value for each tissue and the calf as a whole, without regard to the breed or the plane of nutrition of the dam.

Commercial feeding stuffs, F. D. FULLER (*Texas Sta. Bul. 268 (1920), pp. 5–233*).—This publication tabulates alphabetically by manufacturers the proximate analyses of samples of feeding stuffs collected during the year ended August 31, 1920. The materials include alfalfa meal, barley chop, dried beet pulp, brewers' dried grains, coconut oil meal, corn bran, corn chop, ground corn cob, corn and cob meal, ear corn chop with husks, unbolted corn meal, corn gluten feed, hominy feed, cold pressed cotton seed (prime and choice), cottonseed feed, cottonseed cake (prime and ordinary), cottonseed meal (prime and ordinary), ground feterita fodder, feterita head chop, kafir chop, milo chop, milo head chop, ground oats, whole pressed peanuts, peanut feed, peanut oil meal (prime and ordinary), rice bran, rice polish, rice screenings, whole pressed velvet bean, ground wheat, wheat bran (with and without screenings), brown, gray, and white shorts (with and without screenings), wheat mixed feed, wheat screenings, red dog, meat scrap, shrimp scrap, and a variety of proprietary mixtures. The sample of shrimp scrap analyzed contained 49.96 per cent crude protein.

A table showing the average composition of most of the varieties of feeds analyzed is included, as well as introductory matter dealing with the administration of the State feed law.

The Texas Feed Law.—Requirements and administration, F. D. FULLER (*Texas Sta. Control Circ. F (1919), pp. 5–20, figs. 2*).—This contains the text of the Texas Feed Law, definitions of feeding stuffs, etc. Most of the material is also given in revised form in the bulletin noted above.

Feeding ground rough rice, etc., to horses, mules, hogs, and dairy cattle, W. H. DALRYMPLE ET AL. (*Louisiana Stas. Bul. 179 (1921), pp. 8*).—To show that rough rice and brewers' rice can be fed to live stock without injurious results, feeding experiments with hogs and dairy cows are reported, and the mule feeding experiments reported in Bulletin 122 (E. S. R., 23, p. 672) are reviewed.

In the hog feeding test, which was conducted by E. L. Jordan, A. F. Kidder, and L. E. Long, there were 6 groups of 3 shotes each and the feeding period lasted 42 days. The 2 groups receiving the check ration of corn meal and tankage made an average daily gain per head of 2.04 lbs. The feeds given each of the other groups and the average daily gains per head were as follows: Ground rough rice and tankage, 1.86 lbs.; ground rough rice, corn meal, and tankage, 2.19 lbs.; brewers' rice and tankage, 2.05 lbs.; and brewers' rice, corn meal, and tankage, 2.3 lbs. Post-mortem examination showed that the consumption of large quantities of the rice did not produce any injury to the digestive organs.

The experiment with dairy cows was conducted by R. C. Calloway and involved 2 lots of 6 cows each. The control group, which was fed a ration of corn meal, bran, and cottonseed meal, averaged 24.5 lbs. of milk per day during the 60 days of the experiment. The other group was fed ground rough rice and cottonseed meal and averaged 22.5 lbs. of milk. The second mixture was apparently not so palatable as the first, but no injurious effects were observed although the rice formed 80 per cent of the grain mixture.

Prickly pear as a fodder for stock, C. F. JURITZ (*Union So. Africa Dept. Agr., Sci. Bul. 16 (1920), pp. 15*).—This is a compilation of published and hitherto unpublished analyses of the stems, fruits, etc., of *Opuntia* spp., together with suggestions for feeding these materials to stock. There is a bibliography of 25 titles.

Influence of winter rations on the growth of steers on pasture, E. W. SHEETS (*U. S. Dept. Agr., Dept. Circ. 166 (1921), pp. 11, figs. 4*).—The results of the experiments previously noted from Department Bulletin 870 (E. S. R., 44, p. 176) are here summarized, mainly in the form of graphs.

Feeding yearling steers, C. E. STOCKDALE (*West Virginia Sta. Circ. 34 (1921), pp. 4, fig. 1*).—This is a more brief summary of the results noted above.

The inheritance of the muzzle color in the cattle breed of Stjernsund, H. FUNKQUIST (*Hereditas, 1 (1920), No. 3, pp. 343–363, figs. 3*).—This is a compilation of a large number of herdbook records of the color of the rhinarium in the Stjernsund breed of cattle. Since in some cases parents with flesh-colored muzzles produced offspring with dark muzzles, and in others individuals with flesh-colored muzzles were descended from two dark-muzzled parents, it is concluded that at least two factors, *G* and *P*, are responsible for muzzle color. *G* produces flesh color and *P* in the absence of *G* produces pigmented muzzle. The phenotype *gp* represents the recessive flesh-colored muzzle. The suggestion is also made that there is a second *P* gene (P_1), and that the two are duplicate genes. Individuals with spotted or mixed muzzles are thought to have the formula $ggPpp_1p_1$ or $ggppP_1p_1$.

Grain sorghums v. corn for fattening lambs, J. M. JONES, R. A. BREWER, and R. E. DICKSON (*Texas Sta. Bul. 269 (1920), pp. 3–13*).—A 95-day feeding experiment in the winter of 1919–20 with 6 lots of 20 59-lb. lambs is reported. Each lamb received an average ration of 1.08 lbs. of grain, 0.14 lb. of cottonseed meal, and 1.89 lbs. of alfalfa hay. The grains fed in the different lots and the average daily gain per lamb were as follows: Ground corn (as a check), 0.393 lb.; ground milo, 0.394 lb.; ground milo heads, 0.362 lb.; ground feterita, 0.36 lb.; ground feterita heads, 0.339 lb.; and ground kafir, 0.372 lb. The lot fed milo required 3.1 lbs. of concentrates and 4.81 lbs. of alfalfa per pound of gain.

Analyses of the feeds offered and determinations of the Fraps productive (fat) values (E. S. R., 35, p. 561) are included.

Field peas for fattening lambs, T. W. LONSDALE (*New Zeal. Jour. Agr., 21 (1920), No. 3, p. 140*).—At the Moumahaki Experimental Farm a lot of 59-lb. lambs on rape pasture gained 9.41 lbs. per head in 3 weeks, while a similar lot of 56-lb. lambs on an equal area of field pea pasture, seeded the same day as the rape, gained 12.68 lbs. per head.

Studies on the Münchenlohra flock of Merino mutton sheep, C. OHLY (*Arb. Deut. Gesell. Züchtungsk., No. 24 (1920), pp. 110, pls. 9*).—This is an account of a large sheep ranch established about 1863. The foundation stock consisted of French Merinos, and the flock, like a similar one described by Schmehl (E. S. R., 28, p. 366), has been maintained by intensive inbreeding from which no ill effects have come. A history of Merino breeding in Germany during the early part of the nineteenth century is included.

Annual wool review for 1919 and 1920, J. B. MCPHERSON (*Bul. Natl. Assoc. Wool Manfrs., 50 (1920), No. 1, pp. 34–115, pl. 1; 51 (1921), No. 1, pp. 29–114, pls. 4*).—These are the customary yearly reports giving statistics of domestic wool production and the wool trade of the United States and other countries, and are similar to those formerly prepared by Battison (E. S. R., 42, p. 770).

The reindeer industry in Alaska, G. J. LOMEN (*Jour. Heredity, 11 (1920), No. 6, pp. 243–252, pl. 1, figs. 9*).—The author describes the growth of the reindeer industry in Alaska since the first importations from Siberia in 1892.

Swine [feeding in Guam], C. W. EDWARDS (*Guam Sta. Rpt. 1919, pp. 13–16, fig. 1*).—Two lots of 4 pigs each were used in a study of the tethering method practiced by the Chamorro farmers in feeding their pigs. The lot kept tethered made a total gain of only 43 lbs. during the four months of the experiment, whereas the lot with a free range of Para grass pasture gained 144.5 lbs. although they were given only as much concentrate feed as the tethered lot consumed.

In an experiment with growing swine 4 native pigs were fed a ration composed of corn meal, ground cowpeas, and cooked sweet potatoes (characteristic native feeds) and made a total gain of 121 lbs. in the 60 days of the test. Another lot fed corn meal, ground oats, and meat scrap gained only 96 lbs. in the same period.

A progress report is included of studies of velvet beans as a feed for brood sows.

The rate of ovulation in the domestic fowl during the pullet year, S. BRODY (*Jour. Gen. Physiol., 3 (1921), No. 4, pp. 431–437, fig. 1*).—This contribution from the Missouri Experiment Station is an attempt to express egg production by the mathematical formula for an autocatalytic monomolecular reaction employed by Robertson (E. S. R., 36, p. 263) and others to estimate the rate of growth of animals and plants. The formula in the form here used is

$$\log \frac{x}{A-x} = K(t-t_1),$$

where A is the number of eggs laid in the natural laying season, x is the number of eggs laid from the beginning of this season to time t, t_1 is the time required to produce the first half of the eggs laid during the season, and K is a constant to be determined from the data at hand. Since egg records are usually tabulated by months from November to October, A is assumed equal to the number of eggs laid in this period, and t and t_1 are measured in months with origin at November 1.

For the 4,210 Barred Plymouth Rock pullets discussed by Pearl and Surface (E. S. R., 24, p. 675), $A=129$ eggs, $t_1=5.9$ months, and $K=0.212$. For 1,000 White Leghorn pullets at the Storrs egg laying contests (E. S. R., 41, p. 870), $A=163$ eggs, $t_1=6.64$ months, and $K=0.235$. Tabulations are presented showing the concordance between the actual and the computed egg records for the two sets of data. The agreement was particularly good from January to August. Discrepancies in the other months are attributed mainly to the failure of the natural laying season to coincide with the calendar year.

Elements of higher fecundity, M. E. DICKSON (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 145, 146*).—Records of egg-laying tests are cited to show that there is little difference between breeds in average egg records per hen. This result is attributed to the uniformity of conditions at contests and is held to demonstrate the futility of breeding for egg production.

Mineral content of southern poultry feeds and of other feed mixtures and their potential acidity and potential alkalinity, B. F. KAUPP (*N. C. Dept. Agr. Bul., 41 (1920), No. 17 [North Carolina Sta. Tech. Bul. 19] pp. 42, fig. 1*).—This consists of material in two papers previously noted (E. S. R., 39, p. 577; 44, p. 473).

[Poultry feeding experiments in Guam], C. W. EDWARDS (*Guam Sta. Rpt. 1919, pp. 19, 20*).—In a study of hand-squeezed fresh grated coconut as a supple-

ment to a ration of wheat, corn, oats, and cowpeas for chicks under six weeks of age, it was found that chicks receiving the coconut to the extent of 20 or 30 per cent of the ration grew more rapidly than the check lot not receiving the coconut and showed no ill effects. There was some indication that the use of a higher proportion of coconut produced paralysis, but the lot receiving the coconut to the extent of 75 per cent of the ration did not show a higher mortality than the check lot.

Two tests of rations composed of local feeds were made with chicks from 6 to 12 weeks old. One ration was composed of cracked corn, cracked rice, cracked cowpeas, hand-squeezed coconut, and meat scrap, and the other of cracked corn, hand-squeezed coconut, and meat scrap. In neither case were the gains as great as those produced by a so-called imported ration in which the mash was composed of corn meal, bran, and meat scrap and the scratch feed of corn, wheat, and oats.

Poultry feeding: Meat v. no meat, F. C. Brown (*New Zeal. Jour. Agr., 21 (1920), No. 3, pp. 136, 137*).—Two pens of six White Leghorn pullets receiving only wheat (whole and ground), shorts, and bran for a year produced, respectively, 209.5 and 215.7 eggs per bird, and two other hens receiving meat meal in addition laid 247 and 267.5 eggs per bird.

Effect of lights on common flock, B. F. Kaupp (*Poultry Item, 23 (1921), No. 3, pp. 7–9, fig. 1*).—A pen of 31 Single Comb Rhode Island Red pullets at the North Carolina Experiment Station, which was lighted artificially during the winter so as to make the daily feeding period 15 hours, averaged 147 eggs per bird during the year (1919–20). A similar flock not lighted averaged 104.8 eggs. The former required 7.1 lbs. of feed per dozen eggs and the latter 9.6 lbs.

Coal stove colony brooding, I. L. Owen (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 6, pp. 4, figs. 4*).—Brief popular information is given on colony brooding using a coal-burning stove for heating.

Management of chickens on Texas farms, R. M. Sherwood (*Texas Sta. Circ. 25 (1921), pp. 3–14, figs. 5*).—Suggestions for the selection of breeding stock, the hatching and care of chicks, and the feeding and housing of laying hens are included.

Poultry keeping in the Federated Malay States, H. M. Miller (*Utility Poultry Jour., 5 (1920), No. 6, p. 257*).—In this brief note the author states that the native fowl are mainly of the game type, but that European breeds have been imported and seem to thrive. Paddy is the principal feed used, but other local feeds available are maize, punace (coconut waste after oil extraction), and rubber seeds split and boiled. The author feeds a wet mash composed of ground paddy husks, punace, and boiled tapioca root.

DAIRY FARMING—DAIRYING.

Can "home grown rations" supply proteins of adequate quality and quantity for high milk production? II, E. B. Hart and G. C. Humphrey (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 189–201, figs. 3*).—The authors report a repetition of their previous experiment (E. S. R., 43, p. 270), using alfalfa hay in place of red clover hay. The rations were made up so that each 50 lbs. provided 250 gm. of nitrogen, and the nutritive ratio was approximately 1 : 7.9. All four cows maintained a positive nitrogen balance and maintained their milk flow at its normal level. One of the cows was a Holstein giving 40 to 45 lbs. of milk daily, containing 11.4 per cent of solids.

The difference between these results and those secured with red clover are not attributed to any peculiarity of the alfalfa proteins, but to the fact that alfalfa

hay, having a higher protein content, permits a larger intake of nitrogen. In each experiment about the same proportion of digested nitrogen was used for productive purposes.

Sunflower ensilage, W. C. McKillican (*Farmer's Advocate and Home Jour., 56 (1921), No. 1493, pp. 632, 633*).—The milk records of 7 Milking Shorthorn cows at the Brandon, Manitoba, Experimental Farm during three 3-week periods are summarized. The ration consisted of 10 lbs. of grain, 45 lbs. of silage, 25 lbs. of mangels, and 12 lbs. of straw. Sunflower silage was fed in periods 1 and 3, and the daily milk yields were, respectively, 24.62 and 21.37 lbs. per cow. During the second period, when corn silage was fed, the yield was 23.59 lbs. In the case of each cow the yield during period 2 was greater than the average during periods 1 and 3, the mean difference being 0.59 lb.

It was noticed that abnormally large amounts of urine were discharged during the feeding of sunflower silage, but no injurious effects were observed. The sunflower silage froze more readily than the corn silage, although the moisture content was not higher.

A study in bulls, A. C. McCandlish and L. M. Winters (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 529–539*).—This is the study of the milk and butter fat production of the daughters of five herd sires used at the Iowa State College dairy farm in comparison with the yields of the daughters' dams. The records in each case are corrected to a standard mature age. Two of the bulls produced a distinct increase in records and one a distinct decrease.

Ad interim report on milk production, J. O'Neill, D. Figgis, et al. (*Dublin: Comn. Inq. into Resources and Indus. Ireland, 1920, pp. 24*).—This is a preliminary report of a survey of the status of milk production in Ireland based upon an extensive body of testimony presented by witnesses.

It was found that the annual milk production averaged only about 420 gal. per cow and that many cows gave less than 200 gal. The speedy organization of cow test associations is advocated, part of the expense of operation to be borne by the local creameries. Pending this, it is suggested that the creamery manager keep what records he can of the average production on individual farms. It is also suggested that stud farms be established in dairy districts where bulls of the best dairy strains can be tested in respect to their transmitting qualities. If the progeny prove satisfactory the bulls are to be available for service to neighboring farmers.

Bacterial inhibition.—I, Germicidal action in milk, W. H. Chambers (*Jour. Bact., 5 (1920), No. 6, pp. 527–541, figs. 4*).—The author reports experiments made at the Illinois Experiment Station in which samples of milk were inoculated with pure cultures of *Bacterium coli*, *B. lactis-acidi*, and an unidentified red chromogen isolated from a creamery can. The milks were obtained under aseptic conditions from 11 cows selected because in previous experiments they had shown a low germ content in the udder. Half of each sample was inoculated raw and was held at 37° C., while the other half was heated to 85 or 90° for 2 minutes and then cooled to 37°.

From a comparison of the accounts of the organisms in the raw and in the heated milk it was found that the raw milk had a marked germicidal effect upon *B. coli*, only a slight effect (if any) on the chromogen, and a somewhat accelerating effect on the growth of *B. lactis-acidi*. The germicidal action depended somewhat upon the individual cow. Since the chromogen and the *B. lactis-acidi* showed considerable clumping in the raw milk cultures and *B. coli* showed but little clumping, it is concluded that there is no common relation between agglutination and bacterial inhibition except that both are destroyed by heating the milk.

The sporogenes test as an index of the contamination of milk, S. H. AYERS and P. W. CLEMMER (*U. S. Dept. Agr. Bul. 940 (1921), pp. 20, pls. 8*).—In experiments made in the Dairy Division neither the original Savage test (E. S. R., 25, p. 877) nor the Weinzirl-Veldee test (E. S. R., 34, p. 272) gave results which were of quantitative value in estimating the contamination of milk with *Bacillus enteritidis sporogenes*. A modification of the Savage method in which each of the 10 tubes is filled with 20 cc. of the sample instead of 2 cc. proved fairly satisfactory. Experiments also showed that dirty utensils do not contaminate milk with spores of *B. enteritidis sporogenes*, and that the only important sources of the spores is manure.

Detection of manurial pollution in milk by the anaerobic spore test, J. WEINZIRL (*Amer. Jour. Pub. Health, 11 (1921), No. 2, pp. 149–152, fig. 1*).—This paper supplements that of Weinzirl and Veldee (E. S. R., 34, p. 272). Since *Bacillus sporogenes* is not the only anaerobe present in cow manure, the name "*B. sporogenes* test" is abandoned and "anaerobic spore test" substituted. A single test tube containing 5 cc. of the sample is now used in place of the three tubes formerly employed.

It was found that about 25 per cent of the market milk of Seattle and Yakima, Wash., gave evidence of manurial pollution.

Pure culture starter for butter making, A. T. CHARRON (*Quebec Min. Agr. Rpt., 1920, pp. 64–67*).—In an experiment at the Provincial Dairy School, St. Hyacinthe, Quebec, 14 samples of pasteurized cream were churned without starter and 15 with starter. Competent judges who scored the butter for flavor at intervals during storage were unable to detect any superiority in the butter made with starter.

The gas production of Streptococcus kefir, J. M. SHERMAN (*Jour. Bact., 6 (1921), No. 1, pp. 127–131*).—The cultures of *S. kefir* isolated from Cheddar cheese by Evans (E. S. R., 39, p. 385) were studied in the laboratories of the Dairy Division, U. S. Department of Agriculture. The author's observations indicated that this organism utilizes the lactose but not the peptone of lactose broth to produce carbon dioxid. Since carbon dioxid production in Cheddar cheese continues long after the disappearance of the lactose, it is concluded that relatively little of the gas produced during curing can be attributed to *S. kefir*.

VETERINARY MEDICINE.

The importance of research in animal pathology to agriculture, T. SMITH (*Nebr. Univ., Agr. Col. [Pamphlet], 1920, pp. 23*).—This is an address given at the dedication of the animal pathology and hygiene laboratories of the University of Nebraska in September, 1920.

Proceedings of the Ohio State Veterinary Medical Association, 1919 (*Ohio Vet. Med. Assoc. Proc., 1919, pp. 153*).—Included in the proceedings are the following papers: The Pathology of the Reproductive Organs in Sterility, by E. T. Hallman (pp. 109–114); Hemorrhagic Septicemia in Swine, by E. A. Cahill (pp. 115–121); Some New Surgical Methods, Illustrated, by N. S. Mayo (pp. 122, 123); Tuberculosis Eradication, by J. E. Gibson (pp. 124–135); Stomach and Intestinal Ailments of Ruminants, Therapeutical Advice, by F. L. Carr (pp. 136–141); A Report of Anthelmintic Experiments Conducted at the Ohio Experiment Station, by D. C. Mote (pp. 142–147); and Observations in the Control of Contagious Abortion of Cattle, by C. W. Eddy (pp. 148–153).

Annual reports of the official veterinarians of Prussia for 1912 and 1913, NEVERMANN (*Veröffentl. Jahres-Vet. Ber. Tierärzte Preuss., 13 (1912 [pub. 1914]), pt. 1, pp. VI+156, pls. 16, figs. 1; 13 (1912 [pub. 1920]), pt. 2, pp.*

IV+143; 14 (1913 [pub. 1920]), pt. 1, pp. VI+115, pls. 4).—These are the thirteenth and the first part of the fourteenth annual reports dealing with animal diseases in Prussia in 1912 and 1913, with the statistical data presented in tabular form (E. S. R., 32, p. 577).

Comparative studies on the physiological value and toxicity of cotton seed and some of its products, I. G. Macy and L. B. Mendel (*Jour. Pharmacol. and Expt. Ther., 16 (1920), No. 5, pp. 345–390, figs. 22*).—"Cotton seed kernels, alone or mixed with other foodstuffs, are unpalatable and fatally toxic to rabbits, guinea pigs, and pigeons even when fed with molasses and cabbage; and also to albino mice even when the kernels are supplemented with butter fat and inorganic salts. Rabbits and guinea pigs decline rapidly on cottonseed meal; pigeons and mice decline more slowly, depending upon the source and properties of the meal fed; for different samples of cottonseed meal vary in their immediate effects upon animals. Cottonseed meal was rendered less deleterious and more palatable to rabbits by treatment with moist heat at high temperatures. Thorough extraction with ether was ineffective in detoxicating cottonseed meal.

"The decline of animals feeding on cottonseed meal, resulting in the so-called 'cottonseed meal injury,' is not attributable entirely to inanition. This was demonstrated by determining the food intake of each animal and by conducting control experiments; the latter, in which animals received daily the same quantity of an adequate control diet as that which the cottonseed meal victims consumed, show that death is not the result of starvation, but due to some other factor.

"Cottonseed meal injury is not due to a lack of water-soluble vitamin, first, because all cottonseed diets were fed to rabbits, guinea pigs, and pigeons along with a large quantity of cabbage which is well known to contain sufficient vitamins; secondly, because mice survived six months in good condition on a diet in which the only source of water-soluble vitamin was cottonseed meal; thirdly, because toxic cottonseed meal contains enough vitamin to completely relieve pigeons suffering from polyneuritis in two to five days; fourthly, because yeast, which is very rich in water-soluble vitamin, incorporated in a toxic cottonseed meal diet is ineffective in warding off cottonseed meal injury.

"Some animals are able to recover from the ill effects of cottonseed diets when the deleterious food is replaced by an adequate one, others are not.

"Normal reproduction of albino mice does not take place on a food mixture containing 50 per cent cottonseed meal, 5 per cent butter fat, 4 per cent inorganic salt mixture—a diet which one would regard as adequate; the second generation tends to be very weak and unable to reproduce in the normal way.

"The most characteristic clinical symptoms of cottonseed meal injury in rabbits, guinea pigs, pigeons, and albino mice are emaciation, loss of appetite, weakness, rough hair and unkempt appearance, disturbance in breathing, finally coma and perhaps paralysis. Macroscopic post-mortem examination reveals dilation of the right side of the heart, and usually congestion of the liver, kidneys, and in many cases, the lungs. Splanchnic congestion was frequent, and if the intestines were not hermorrhagic they often appeared friable and easily ruptured."

On the classification of the Ascaridae, II, H. A. Baylis (*Parasitology, 12 (1920), No. 4, pp. 411–426, figs. 7*).—The second part of this paper, the first part of which has been previously noted (E. S. R., 44, p. 375), deals with the Polydelphis group, with some account of other ascarids parasitic in snakes.

Experimental investigation of the bactericidal action of metals (copper and silver) in vivo, T. Matsunaga (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82*

(*1918*), *No. 3–4, pp. 311–317*).—Powdered silver or copper, when injected subcutaneously into guinea pigs together with various pathogenic organisms, was found to inhibit the growth of these organisms. Good results were obtained with anthrax, diphtheria, and tetanus bacilli. The author is of the opinion that these results, together with similar results obtained by others in vitro, indicate the possible value of powdered metals in wound treatment.

Investigation of specific disinfectants.—II, The action of salts and ions on bacteria, P. EISENBERG (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 82* (*1918*), *No. 2, pp. 69–208*).—This extensive investigation is in continuation of a previous study [1] in which it was shown that the action of many anilin dyes, both basic and acid, on various microorganisms was selective in that the Gram-positive were much more easily destroyed than the Gram-negative. In an effort to discover the relation between chemical constitution and bactericidal action, the antiseptic and bactericidal action of a large number of inorganic salts was tested on a number of bacteria by the methods employed in the previous study. The results obtained are presented in a series of tables indicating the relative effect on the 12 organisms studied of different positive and negative ions.

Comparative study of new substitutes for saponified cresol solutions, F. DITTHORN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 82* (*1918*), *No. 6, pp. 477–483*).—A study is reported of the relative solubility and bactericidal action of six commercial substitutes for cresol, Fawestol, Cresotin Cresol, Betalysol, Cresolit, Opticreso, and Tricresol. All were found to have strong bactericidal power in concentrations furnishing from 1 to 2 per cent of cresol.

Some new disinfectants, F. DITTHORN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 84* (*1920*), *No. 6, pp. 486–496*).—Continuing the examination of substitutes for cresol soap solutions noted above, the author reports the results of a study of the relative bactericidal power of the following commercial preparations: Tetosol, Cresitol, and Caral A (cresol with a cresol soap solution), Parol and Caral B (chlorcresols), Optiform and Caral C (formalin soap preparations), and Kentausan (a cresol formaldehyde preparation).

The disinfecting value of the three cresol isomers (meta-, ortho-, and paracresol), F. DITTHORN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 82* (*1918*), *No. 6, pp. 483–491*).—The relative bactericidal powers of the three isomeric forms of cresol were found to be in the decreasing order of the meta, para, and ortho compounds. So little difference was, however, noted in their strength that the practice of preparing an ortho-free cresol is thought inadvisable, and a mixture of the three is instead recommended as having a stronger action than any one isomer alone.

Insoluble serum, A. BESREDKA (*Compt. Rend. Soc. Biol.* [*Paris*], *83* (*1920*), *No. 13, pp. 467, 468*).—The author states that by dissolving desiccated serum (5 gm.) in 10 cc. of physiological salt solution and heating the solution on the water bath for an hour at from 57 to 58° C. a yellow, transparent mass of coagulated serum is obtained which retains all its original properties except solubility. By triturating the powder in water or a very dilute phenol solution, an emulsion is obtained which can be used in place of ordinary serum for intratracheal injections and is said to have the advantage, owing to its insolubility, of offering no danger to an animal in a state of anaphylaxis. Intravenous injection is to be avoided on account of the possibility of embolism.

Attempts at purification of therapeutic sera, A. BESREDKA (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 26, pp. 1628, 1629*).—The emulsion of solidified serum noted above has been found to separate on standing for 24 hours into two layers, the lower a yellowish turbid liquid containing the protein matter

[1] Centbl. Bakt. [etc.], 1. Abt., Orig., 71 (1918), No. 5–7, pp. 420–503.

and the upper a transparent limpid liquid which, on evaporation in vacuo, gives a residue equal to one-tenth of the original serum. This liquid is even less toxic for the sensitized animal than the total serum, and can be injected directly into the blood in doses of 1 cc. or more without provoking anaphylactic symptoms. Experiments with antitetanus serum prepared in this way have indicated that the antibodies are concentrated in this liquid.

Epidermoid carcinoma in domesticated animals, S. A. GOLDBERG (*Cornell Vet., 10 (1920), No. 4, pp. 235–244, pls. 5*).—A review of the literature and the cases here reported have led the author to conclude that (1) in the domestic animals the epidermoid carcinomas are the most common of the malignant epithelial tumors, and (2) epidermoid carcinoma originates more frequently at the places of transition between the skin and modified squamous epithelium, or between squamous and other types of epithelium.

The artificial transmission of foot-and-mouth disease to guinea pigs, O. WALDMANN and J. PAPE (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 44, pp. 519, 520*).—The authors report that they have succeeded in transmitting foot-and-mouth disease from swine to guinea pigs by subcutaneous inoculation of virus from a fresh lesion. From the typical lesions produced transfers have been made through five generations. In explaining the failure of previous workers to infect guinea pigs with foot-and-mouth disease, they suggest that the disease in the present epidemic may have been of an unusually high virulence or that the virus may have become so altered through successive swine passages as to be more suitable for guinea pig inoculation.

The detection of glanders in exhumed carcasses by means of the precipitation method, W. PFEILER and A. REHSE (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1918), No. 3–4, pp. 240–242*).—The author reviews the conflicting literature on the reliability of the precipitation test for diagnosing glanders in exhumed carcasses, and reports three cases in which positive results were obtained with this reaction while other methods failed.

Immunization with bile against rinderpest, CURASSON (*Bul. Soc. Cent. Méd. Vét., 96 (1920), No. 8–10, pp. 142–145*).—The author reports considerable experience in the French Sudan in the immunization of cattle against rinderpest by means of bile from animals affected with the disease. A high percentage mortality resulted following inoculation with bile from animals having a virulent form of the disease, but a low percentage mortality following inoculation with bile from animals having only a slight attack. The inoculation thus produces an attack of the disease, mild or severe, according to the nature of the bile used, and does not confer a state of active or passive immunity in the usual sense of the word.

Chemical composition of the tubercle bacillus (*Ann. Inst. Pasteur, 34 (1920), No. 8, pp. 497–546*).—This extensive study of the chemical composition of the tubercle bacillus is presented in three parts, as follows:

I. *The organic composition of the tubercle bacillus,* A. Goris (pp. 497–533).—The literature on this phase of the study is reviewed and discussed under the headings of researches on the extraction of the organic constituents of the bacillus, particularly fats, and analytical study of these constituents. This is followed by the report of the author's investigations following the same general scheme, the material used being a mixture of human and bovine tubercle bacilli such as is used at the Pasteur Institute in the preparation of tuberculin. The results of this study are summarized as follows:

The lipoid constituents of the tubercle bacillus include a new substance of the nature of an ester soluble in chloroform and insoluble in ordinary ether, and forming on hydrolysis crotonic acid mixed with a little isocrotonic acid. On account of its transparent appearance the ester has been given the name "hyali-

nol." Other constituents found were a waxy phosphatid-containing mixture, giving on hydrolysis mycol, another alcohol of high molecular weight, and a mixture of palmitic and stearic acids; a wax consisting principally of mycol laurate, a substance melting at 300° C. but obtained in too small quantities to be studied; and a fat consisting essentially of the glycerids of oleic, palmitic stearic; and arachidic acids with a small quantity of caproic and butyric acids. Among the nonlipoidal substances were found a nucleoprotein giving reactions analogous to but less marked than tuberculin and amino acids resulting from the digestion of protein matter by the bacillus.

II. *Inorganic constituents of the tubercle bacillus*, A. Goris and A. Liot (pp. 533–537).—The tubercle bacilli yielded about 2.5 per cent of ash consisting chiefly of phosphates with some sulphates. The metals in decreasing order consisted of sodium, potassium, calcium, and magnesium, with traces of iron, manganese, and zinc, the last element being considered accidental.

III. *Study of acid resistance*, A. Goris and A. Liot (pp. 537–545).—The acid resistance of the tubercle bacillus was found to be due chiefly to certain of the lipoidal substances with which it is impregnated, the most active substances being the waxes, together with the free alcohol liberated with their saponification.

Serum diagnosis of tuberculosis with the antigen of Besredka, A. Bass (*Compt. Rend. Soc. Biol.* [*Paris*], *83* (*1920*), *No. 28, pp. 1261, 1262*).—In the experience of the author the complement fixation test for tuberculosis is always positive in confirmed tuberculosis and always negative in healthy subjects, while in doubtful cases a negative reaction indicates absence of lesions.

Improper tuberculin tests, J. R. Mohler (*Cornell Vet., 10* (*1920*), *No. 4, pp. 229–234*).

Tuberculosis literature in France during 1914–1919, G. Ichok (*Internatl. Centbl. Gesam. Tuberkulose Forsch., 14* (*1920*), *No. 10–12, pp. 195–228*).—This is a condensed review of French contributions to the study of tuberculosis, with many references to the original literature.

On some filariid parasites of cattle and other ruminants, C. L. Boulenger (*Parasitology, 12* (*1920*), *No. 4, pp. 341–349, figs. 7*).—Descriptions are given of *Setaria labiato-papillosa* (Aless.), *S. digitata* (v. Linst.), *S. marshalli* n. sp., and *S. hornbyi* n. sp.

Pseudo-actinomycosis or streptotrichosis in the camel, F. E. Mason (*Agr. Jour. Egypt, 9* (*1919*), *pp. 7–13, pls. 2*).—The author fails to find any previous record of streptotrichosis in the camel, nor of any streptothrix having the peculiar characters of the form here described as new under the name *Streptothrix cameli.*

Diseases of swine, W. W. Dimock (*Vet. Alumni Quart.* [*Ohio State Univ.*], *8* (*1920*), *No. 2, pp. 37–45*).—This is a general discussion of the classification, diagnosis, and methods of control of diseases of swine as they concern the practitioner.

Infectious abortion in sows, F. M. Hayes and J. Traum (*Duroc Digest, 3* (*1920*), *No. 2, pp. 44, 45*).—This is a brief discussion of the symptoms of contagious abortion in swine, interpretations of reaction to the agglutination test, methods of drawing and shipping the blood for the test, and precautions to be taken toward the prevention of the disease.

The turkey an important factor in the spread of gapeworms, B. H. Ransom (*U. S. Dept. Agr. Bul. 939* (*1921*), *pp. 13*).—In examinations made of the tracheas of 635 chickens that were killed for sale at poultry stalls in Washington, D. C., during the winter months, none of which fowls were less than 6 months old, no infestation with *Syngamus trachealis* was detected. Tracheas

of 679 turkeys from the same market, all of which birds were at least 6 months old, gave an infestation of 22.5 per cent.

In artificial infestation experiments in which gapeworm eggs containing fully developed larvae were fed to incubator chickens, there resulted an infestation of 87 per cent in chickens up to the age of 4 weeks, 84 per cent from 5 to 8 weeks of age, 66 per cent from 9 to 20 weeks of age, and 29 per cent from 21 weeks to adult age.

The investigations reported led the author to conclude that the turkey is probably the natural host of the gapeworm, and that adult as well as young turkeys commonly harbor gapeworms, though they may show no symptoms of infestation. "The turkey is apparently the chief agent in the spread of gapeworms to new localities and is apparently the principal source of infection to the soil on poultry farms where gapes is prevalent. Gapes among chickens appears to be more prevalent on farms where turkeys frequent the chicken runs than on farms where there are no turkeys. Available evidence indicates that gapes has a tendency to disappear from farms following the removal of turkeys.

"Chickens, unlike turkeys, are readily susceptible to infection with gapeworms only while they are young. They become less susceptible to infection as they grow older. Adult chickens, at least in some localities, rarely harbor gapeworms, and hence in such localities are seldom likely to spread infection. In those instances in which gapeworms develop in adult chickens or chickens approaching maturity, the parasites are likely to live only a short time.

"Ground contaminated by gapeworms is likely to remain infective for at least a year after further infection of the soil has ceased. Losses from gapes can be greatly reduced, if not altogether avoided, by keeping young chickens on ground that has not been exposed to contamination within at least a year and that is protected from further contamination by excluding turkeys from it during its occupancy by the chickens. As gapeworms appear rarely to occur in adult chickens, brood hens may be associated with the young chickens with probably little risk of infection to the latter from that source. The simplest means of preventing or reducing losses from gapes appears to be the exclusion of turkeys from farms where chickens are raised."

Sod disease of chickens (vesicular dermatitis), I. E. Newsom and W. H. Feldman (*Colorado Sta. Bul. 262 (1920), pp. 12, figs. 6*).—This is an account of an affection, largely of small chicks during the first month of life, that has not been previously described. In some cases old hens are also affected. The station has been receiving requests for information concerning the disease for the past 7 or 8 years, and it has been observed by one party at Elba, Colo., practically every year for the past 13 years. Observations indicate that it is quite prevalent throughout all of Colorado east of the Rocky Mountains wherever prairie sod remains unbroken, but it has not been reported from the western slope of the State. It appears to be fairly well known in western Kansas and Nebraska and in eastern Wyoming. In some localities it is so serious as to cause settlers to stop raising chickens entirely, and in several instances it has resulted in the loss of from 50 to 90 per cent of all young chickens. It has also been the experience of some that the disease is extremely virulent in certain years, only to disappear entirely in the year succeeding, though there is no evidence that it is associated with either dry or wet years.

The disease frequently becomes apparent during the first week of life, the young chicken becoming dull and remaining behind the rest of the brood. Close examination at this time often reveals the presence of blisters between the toes or possibly small scabs on top of the toes and on the lower part of the leg. "Scabs have not been found on the under surface of the toe. The whole foot

is usually swollen and is very tender to the touch. Owing to the pain, the chicken sits down a great deal. In the course of two or three days the vesicle ruptures and is replaced by a thick, heavy scab. The toes increase in size and become very rigid. Occasionally a joint or even a whole toe drops off. If the chicken survives the scabs disappear in the course of two or three weeks longer, and the toes become extremely distorted, turning usually in an upward direction so that the only portion of the foot that touches the ground is the heel. During the scabby stage, chickens pick at the feet a great deal.

"The symptoms may or may not appear on the head, and in some instances they may show on the head and not on the feet. In the early stages small vesicles may be found in the unfeathered skin around the bill and around the eyes. These are followed by considerable swelling, increasing redness, and later by the presence of scabs. Often the eyelids become glued together and the chicken becomes totally blind. It appears that many chickens starve in this stage because of inability to find food. Older chickens are not nearly so frequently affected, but when the disease does attack them it produces similar conditions of the feet and shows considerable swelling around the eyes, with rather extreme redness. Vesicles have not been noted in hens, it requiring from one to two weeks in most instances for the disease to prove fatal, whereas in small chickens the disease may terminate fatally in one or two days.

"The flock mortality may run as high as 90 per cent in virulent outbreaks. Generally, however, it will not average above 20 per cent. Most of the affected birds die, and the rest are practically worthless, since they become stunted and their feet are so distorted that they can not get around readily. As a consequence they are frequently destroyed, even though they appear to recover from the acute symptoms of the disease. Therefore, it may safely be said that of the chickens which are affected the loss is practically 100 per cent."

The disease is more apt to be mistaken for roup than any other malady, but can easily be differentiated, since roup is largely a cold weather disease and sod disease appears in summer. Again, sod disease affects more especially small chickens, whereas roup, appearing in the winter time, is more likely to be a disease of adults. The inflammatory disturbance in sod disease seems to be confined to the skin, whereas in roup it is more apt to be due to accumulation within the maxillary sinus. While the comb and wattles may become scabby, they are not warty as in contagious epithelioma. Bumble foot may be differentiated, since it is usually an inflammatory condition of the deeper structures and is seldom associated with the presence of scabs on the upper surface of the toes. Scaly leg may be differentiated by finding the mites and also by the fact that it is largely a disease of the leg instead of the toe.

While the disease is suspected of being infectious, investigations have failed to give any support to the supposition. Studies have shown the disease to be associated with sod, having never been known on irrigated land, nor does it occur on dry land where the sod has been broken up and the fields have been cultivated for a few years, but it does occur in irrigated districts in places where the chickens have the run of sod above the irrigating ditch.

Dipping the affected parts in kerosene oil appears to have been the most effective and practical means of treatment, being especially reliable for older chickens where the disease is more chronic. No treatment, however, seems to be of much avail in very young birds. As a means of prevention it is recommended that chickens be confined to plowed ground.

A micrococcus infection of chicks, H. B. Goodale (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 5 (1919), No. 8, p. 64*).—Post-mortem examinations of chicks, which had shown very few symptoms except poor growth

prior to their death, resulted in finding that the lungs were congested or filled with whitish nodules. Although such nodules are usually considered diagnostic of infection with Aspergillus, only numerous cocci, identified as probably *Micrococcus tetragenus*, were found. In one lot about 50 per cent of the chicks died, while the rest were greatly retarded in growth. The litter, although it was clean and good, was apparently the source of the infection, since *M. tetragenus* is known to occur in such material. With later broods sand was used, and with one exception no further trouble was experienced.

Preliminary note on the development of the larvae of Dirofilaria immitis in dog fleas Ctenocephalus felis and C. canis, A. Breinl (*Ann. Trop. Med. and Parasitol., 14 (1921), No. 3, pp. 389–392*).—The experiments carried out have proved that the larvae of *D. immitis*, a parasite commonly found in dogs at Townsville, Australia, can undergo a complete developmental cycle in the dog fleas *C. felis* and *C. canis*. A mature larva on one occasion was found to have penetrated the unbroken skin of a puppy, making its way into the subcutaneous tissue.

RURAL ENGINEERING.

The supply, the price, and the quality of fuel oils for pump irrigation, G. E. P. Smith (*Arizona Sta. Bul. 92 (1920), pp. [4]+393–423, figs. 7*).—The progress results of studies of fuel oils for use in pump irrigation are reported.

The indications are that an adequate supply of gasoline and kerosene is assured for at least a year, but that long-time forecasts are impossible. Engine distillate, gas oil, and so-called twenty-seven-plus, the oils most used for pump irrigation, are being withdrawn from the market in California. The north Texas and Oklahoma fields are considered to be new sources of supply of much promise. Farmers and dealers are advised to make contracts during the winter for the year's oil supply.

The conclusion is drawn that the price of gasoline will fluctuate constantly with changes in the demand and production. Kerosene likewise will fluctuate in price, but should be cheapened somewhat by a reduction in the present freight rates. Gas oil is considered likely to remain at about the present price level. The price of Deisel engine fuel will always approximate that of boiler fuel oil and will be considerably less than prices of the lighter oils. Steam power plants using boiler fuel oil or coal can not furnish power at a cost low enough for pump irrigation districts.

With increasing demand, the tendency is to force the quality downward in gravity to the heaviest grades that the respective engines can burn. It is stated that fuel oils should therefore be purchased with specifications. In this connection the following specifications for California gas oils for pumping engines of the 4-cycle electric ignition type, based on tests reported, are given: The specific gravity shall be above 38° Baumé. The flash point shall not exceed 120° F. and the burning point 150°. The oil shall not contain a measurable quantity of acid either free or liberated during evaporation. When distilled in a standard 100 cc. Engler flask, by the U. S. Bureau of Mines method, the temperature, when 20 per cent is distilled, shall not exceed 375°, when 90 per cent is distilled 500°, and when 50 per cent is distilled 410°, and shall not exceed the average of the temperatures for the 20 and 90 per cent points. The oil shall not contain any water, sand, paraffin wax, free carbon, or any visible solid substance, and not over 0.2 per cent of sulphur. The general requirements for gas oil as compared with gasoline and Deisel engine fuel are shown by table.

Run-off from underdrained land and action of tile drains on ground water level (*Engin. and Contract., 55 (1921), No. 10, pp. 229–231, figs. 3*).—Experiments conducted by the U. S. Department of Agriculture in cooperation

with the North Carolina Department of Agriculture, on the amount of run-off from underdrained land, the relation of run-off to rainfall, and the action of tile drains in lowering the ground water level, are reported, as described by *H. M. Lynde* at the third annual meeting of the southern section of the American Society of Agricultural Engineers, in a paper entitled "Drainage Investigations in North Carolina."

The experiments were conducted on two farms in northeastern North Carolina on areas of 52, 23, 12, 10, and 7 acres thoroughly drained by parallel laterals. The soils on one farm are nonhomogeneous and extremely variable in texture and include loams, sandy and clay loams, and sands. The soils of the other farm are homogeneous and consist of fine sandy loams.

The results are taken to indicate that for such soils texture is the controlling factor in the efficiency of underdrainage. "In nonhomogeneous soils the spacing and depth of drains should be such as to suit average soil conditions as near as they can be ascertained, consistent with economy. In general, in nonhomogeneous soils laterals should be arranged in parallel, straight lines at equal distances apart and at the same average depth. For North Carolina second bottom lands of this character, a minimum spacing of 60 ft. and maximum depth of 3 ft. are recommended. It is not believed that the additional benefits to be derived from spacing them closer or deeper than these figures will justify the cost. For Norfolk and Portsmouth fine sandy loam soils, with a surface slope exceeding 3 in. to the 100, a spacing of 125 ft. and an average depth of 3.5 ft. are recommended for laterals. On slopes flatter than this, a spacing of 100 ft. and a depth of 3 ft. are recommended on account of the possible existence of basins and no surface run-off. The economic rate of run-off to be adopted in the design of underdrainage systems on areas similar to those investigated appears to be 0.25 in. per 24 hours if the Chezy-Kutter formula with n=0.015 is used. . . . Possibly for Norfolk and Portsmouth fine sandy loams with extremely flat topography, it may be advisable to provide for a $\frac{3}{8}$-in. run-off, if the laterals are spaced closer than 100 ft. The grades of the drains on the two experimental tracts are 0.2 per cent or greater and are self-cleaning. Observations on tracts with similar soils where the grades are less than 0.2 per cent appear to indicate that there is danger of silting in the smaller tile, unless the joints are protected, which may be done by wrapping with strips of building paper and covering with pine straw."

Land clearing. M. L. NICHOLS (*Alabama Col. Sta. Circ. 44 (1921), pp. 27, 28*).—Experiments on the removal of fat pine stumps by use of so-called Hercomite, a 60 per cent explosive; 20 and 40 per cent dynamites; and so-called DuBell dynamite indicated that the higher percentage explosives were the most economical, as more power was obtained for less money.

It was found that the cost of burning stumps was $15 per acre with no returns. When blasting, the value of the wood, exclusive of the hauling, more than equaled the cost of the labor and explosives.

A new method of blasting stumps was tested, in which the charge was placed deep in the heart of the tap root at least 2 ft. down. Under these conditions dynamite was able to cut the tap root off 18 in. deep and to split the stump.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1921), Nos. 35, pp. 40, figs. 149; 36, pp. 32, figs. 17*).—These numbers of this periodical contain data as to Federal Aid Allowances—Project Statements Approved and Agreements Executed in January and February, 1921; and the following articles:

No. 35.—The Motor Truck Impact Tests of the Bureau of Public Roads, by E. B. Smith (see p. 82); Report on California Highways Ready; and Construction and Maintenance in Illinois.

No. 36.—Outstanding Features of Report of the California Highway Study; 9,231,941 Motor Cars and Trucks Registered by the States in 1920, by A. P. Anderson; Resurface Concrete Road with Reinforced Concrete, by T. M. Keene.

The motor truck impact tests of the Bureau of Public Roads, E. B. Smith (*U. S. Dept. Agr., Public Roads, 3 (1921), No. 35, pp. 3–36, figs. 14*8).—This is a progress report of these impact tests (E. S. R., 42, p. 780.)

It is stated that the results presented must not be considered as final. The indications are, however, that the impact value depends very largely upon the tire equipment. The condition of the tire determines the amount of cushioning effect it may offer. Thin or worn solid rubber tires, even though they are very wide, produce very high impact forces. The deflection of the tire depends upon its depth and quality, and any condition of the tire which adds to its deflection will serve to reduce the impact.

The actual shape and construction of the tire seem to have considerable influence upon its cushioning effect. So far as they have been tested, cushion tires seem to offer a decided advantage in reducing the impact. In this connection it is stated that the name "cushion" on a tire does not necessarily make it such a tire, and that some definitions and deflection requirements should be adopted for the classification of tires.

Pneumatic tires show a very great influence in reducing impact values, and the impact produced with such equipment seems to increase only very slightly with the speed. The width of the tires or the load per inch of tire width has only very little controlling influence upon the impact. The deflection of the tire is the main factor, and this is controlled only slightly by its width. A decrease in tire width increases the load per square inch of tire, which in turn causes a slightly greater tire deflection. Thus, a large tire width does not tend to decrease the impact but rather to increase it, and a very wide but thin solid tire will give much higher impact forces than a narrow thick one.

Impact increases with the speed of the truck, but the relation is not a simple arithmetical ratio, nor can it be expressed simply as a certain power of the speed ratio. When striking an obstruction or irregularity, there is approximately a straight-line relation between impact and speed, but the equation of this curve depends upon the characteristics of the truck, the height of the obstruction, and the deflection of the tire as well as the speed. For approximate comparisons it is stated that the impact increases with the increase of speed from 10 to 100 per cent for solid tires, from 10 to 75 per cent for cushion tires, and from 0 to 10 per cent for pneumatic tires. An average of any of these limiting percentages must not be used. When dropping from one level to another the speed affects the impact value somewhat according to the percentage variations given, up to a critical speed of from 9 to 12 miles per hour. Beyond the point of critical speed at which the wheel falls freely there should be no increase in impact value.

Although heavy unsprung weights may give higher impact values than lighter unsprung weights, this is not the major controlling factor because such factors as tire equipment, spring stiffness, load carried, and speed, may have a greater influence and overcome any difference due to the unsprung weights. It is possible to so operate a light-weight truck under certain load and speed conditions that it will produce as high impact values as a heavy truck under certain conditions.

The impact values may be as high as seven times the load at one rear wheel for a solid tire when striking a 1-in. obstruction at 16 miles per hour, an average value being about four times. It is considered probable that for pneumatic tires the maximum impact value is not more than one and three-fourths times the load at one rear wheel and an average value is not more than 25 per cent.

The value of scientific investigations for the determination of the technical properties of wood, J. P. PFEIFFER (*De Waarde van Wetenschappelijk Onderzoek voor de Vastselling van Technische Eigenschapen van Hout. Amsterdam: J. H. de Bussy, 1917, pp. XII+290+[6], pls. 4, figs. 38*).—This book deals with microscopic, chemical, biological, and mechanical studies of wood as a structural material, with particular reference to tropical varieties. A review of the structural uses of tropical woods is followed by chapters on microscopic studies of woods in general and of tropical woods in particular. Other chapters deal with physical, chemical, and biological studies of these woods and with their mechanical properties, the purpose being to show the relations between these factors as affecting the structural use of the wood. Actual test data on six different types of tropical woods are included.

Alcohol production from molasses, G. M. APPELL (*Chem. Age [New York], 29 (1921), No. 2, pp. 53–57, fig. 1*).—General descriptions are given of the various processes which may be used for the manufacture of alcohol from black strap molasses. It is concluded that when the raw sugar industry receives $5 per ton for its black strap molasses it is sacrificing $15 worth of fertilizer ingredients, $14.50 worth of chemicals, and $20 worth of motor fuel at 30 cts. per gallon.

Scientific boiler feed water regulation: Can it be attained in practice? R. MOELLER (*Milk Dealer, 10 (1921), No. 6, pp. 10, 12, 14, 16, figs. 6*).—Methods and apparatus for the regulation of boiler feed water in dairies are discussed.

Investigation of the farm machinery business in Minnesota, J. H. HAY (*Minn. Dept. Agr. Bul. 10 (1920), pp. 27*).—This bulletin reports the results of an investigation of the practices prevailing in the manufacture and distribution of farm machinery in Minnesota and of the prices and profits involved in these activities.

It is concluded that the cost of labor and material used in the manufacture of farm implements for the years 1914, 1916, 1918, and 1920 equaled and in many cases exceeded factory prices of farm implements for the same years. The manufacturers within recent years have eliminated almost all the jobbers and wholesalers from the distributing part of the machinery business, apparently for the purpose of establishing a more direct route between factory and farmer and to reduce expensive distribution. This move did not translate itself, so far as was learned, into a reduction of price to the consumer. "It is reasonable to believe, therefore, that when it was not reflected in lower prices to the farmers, this gain was absorbed by the manufacturer."

It is further stated that exclusive contracts between manufacturers and local dealers are now considered obsolete, and that all retailers are practically on a cash basis.

Data on prison machinery manufacture and on the activities of implement associations in the regulation of retail prices are also included.

The report of the Departmental Committee on Agricultural Machinery, D. NEWTON (*Jour. Farmers' Club [London], 1921, pt. 1, pp. 18*).—The principal features of this report are presented and discussed.

Manual for the guidance of county councils and their architects in the equipment of small holdings (*London: Bd. of Agr. and Fisheries, 1919, 2 ed., rev. and enl., pp. 53, figs. 37*).—This manual, in two parts, is a short and condensed review of the more usual requirements of cottages and farm buildings on small holdings in England, with suggestions as to how they may be reasonably and economically met. Part 1 deals with the planning and construction of cottages, and includes plans and data on details of construction. Part 2 deals with the planning and construction of farm buildings and also includes both general and working drawings.

Dairy barns, O. R. ZEASMAN, G. C. HUMPHREY, and L. M. SCHINDLER (*Wisconsin Sta. Bul. 325 (1921), pp. 34, figs. 25*).—Popular and semitechnical information on the planning and construction of dairy barns adapted to Wisconsin conditions is given in this bulletin, together with numerous diagrammatic illustrations describing the important features.

It is stated that as direct sunlight is a good disinfectant, it should be used to the utmost. Square projections of walls at the sides and bottom of the window cut off much direct sunlight. Windows should be as near the outside of the wall as practicable. A barn with its longer dimension north and south receives the most sunlight in the forenoon and late afternoon. An east and west position allows the absorption of the most sunlight during the middle of the day, when it is most effective.

A ventilation system is considered necessary, and the King system is said to be satisfactory for Wisconsin conditions. The rectangular barn with a gambrel roof is said to be the most popular in Wisconsin.

Live-stock sales pavilions, W. A. FOSTER and K. C. IKELER (*Iowa Sta. Circ. 67 (1921), pp. 40, figs. 28*).—This bulletin deals with the general subject of live-stock sales pavilions and barns and contains many definite suggestions relating to their planning and construction. It includes also a number of diagrammatic illustrations and plan and detail drawings of recommended types. Considerable information regarding construction details and the organization of breeders' associations and pavilion companies is also given.

The four essential features of the sales pavilion are that it must have a sales ring, satisfactory seating, adequate barn room, and good light. The semicircular shape is said to best meet the requirements for a sales pavilion, and a building about 60 ft. across, permitting a ring 15 to 20 ft. in diameter and comfortably seating from 500 to 600 people, best meets the general requirements for the average sales pavilion.

Poultry house construction, R. H. WILKINS (*Winthrop Col., S. C. [Ext. Pamphlet], pp. [8], fig. 1*).—Plans for poultry houses adapted to South Carolina conditions are given and discussed.

An open front brooder house, G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 187–193, figs. 5*).—General information on the design of an open-front brooder house adapted for the hover over oil-burning brooder stoves is given, together with plans and section drawings.

Concrete houses: How they were built, edited by H. WHIPPLE (*Detroit: Concrete-Cement Age Pub. Co., 1920, pp. 215, pls. 16, figs. 445*).—This book is a compilation of a number of articles descriptive of various types of concrete houses and the details of their construction.

RURAL ECONOMICS AND SOCIOLOGY.

Research and the farmer, E. T. MEREDITH (*Banker-Farmer, 8 (1921), No. 4, pp. 10, 11, fig. 1*).—A sketch of some of the economic results of research by scientists of the U. S. Department of Agriculture into crop and live-stock diseases and pests as applied to agricultural production, as well as some projected lines of investigation, especially into problems of financing production and the marketing of products, is given here.

Washington's home, Mt. Vernon, as a farm, C. J. GALPIN (*World Agr., 1 (1921), No. 4, pp. 65–68, figs. 6*).—This is an abstract of an address given before the Country Planning Conference of the American Civic Association, at Amherst, Mass., in October, 1920, describing the arrangement of the manor house and farm buildings for seclusion and yet convenience to the farming operations. It is illustrated with photographs and a reproduction of a lithograph, dated 1852, furnished for the article by the Library of Congress.

Agriculture in the United States, [E. T. MEREDITH] (*World Agr., 1 (1921), No. 4, pp. 70, 71, fig. 1*).—Information from recent official speeches and reports regarding the work of the U. S. Department of Agriculture relative to the farming industry of the United States is given here.

The agricultural situation, H. C. WALLACE (*U. S. Dept. Agr., Weekly News Letter, 8 (1921), No. 33, pp. 1, 6–8; also in Com. West, 39 (1921), No. 12, pp. 32, 33, 48, 49; Com. and Financial Chron., 112 (1921), No. 2908, pp. 1097–1099*).—This statement is made reviewing the general agricultural situation of the country and noting the disturbing effect of agricultural prices on the farmers' output.

Mobility of the factors of production as affecting variation in their proportional relation to each other in farm organization, J. G. THOMPSON (*Jour. Polit. Econ., 29 (1921), No. 2, pp. 108–137*).—Reorganization of individual farms in large estates, sale and purchase, settlement of estates, renting of additional land by owners, and the changing to more or less intensive types of farming are regarded as phases of mobility of land. Changes with regard to the labor factor are said to be secured by hiring and discharging laborers, variations in the length of working hours and intensity of exertion on the part of farm workers, mutual exchange of laborers among neighboring farmers, the shifting of labor between different branches of farming, physical removal of farm labor from one section of the country to another, and migration of farm laborers. Of all the factors of production in agriculture, capital is regarded as the most varied in the degree of mobility that attaches to it. Methods of shifting include physical transfer from place to place, changed use, withdrawal or replacement of wornout capital, purchase or sale, hiring or leasing, and cooperative ownership and use. The management factor may be increased or diminished by education, by the association of different individuals and of a varying number of individuals in the management of an area, by varying the intensity of the management, by transfer of business ability between agriculture and other lines of business, and by combining other occupations with agriculture.

The choice of crop enterprises based on returns for labor, A. Boss (*Jour. Farm Econ., 3 (1921), No. 1, pp. 30–40*).—This paper sets forth data relative to the return for labor expended on certain Minnesota crops, spring wheat and corn, particularly, as well as notes on the labor expense of potatoes, tobacco, and flax.

Cost of production; its relation to price, A. B. Cox (*Texas Sta. Circ. 26 (1920), pp. 3–11*).—This discussion is intended to state principles operating in price determination and to discuss cost of production as an important factor modifying supply, using the term cost of production in the sense of the expense or money cost. As a consideration in price fixing it is held to be only equally important with the demand, both being subject to wide fluctuations. Farmers and ranchmen are urged to study the commercial side of their business, especially the anticipated price and probable cost of production. The policy of diversification and cutting down cost is recommended in coping with the present situation.

What the retailer does with the consumer's dollar, T. MACKLIN and P. E. MCNALL (*Wisconsin Sta. Bul. 324 (1921), pp. 3–22, figs. 2*).—The results of an investigation of retail marketing of food products in the city of Madison, conducted by the station cooperating with the Wisconsin Division of Markets, are presented.

It was found that retailers of food received margins of from 15 to 16 per cent during 1919. Operating expenses took from 11.7 to 12.3 cts. on an average of each dollar's worth of goods sold, while balances averaged 2.5 to 4.5 cts. It is said that Madison food retailers did not profiteer in 1919, that they were

strictly competitive, and that they did not receive exorbitant salaries or profits. The inefficiency of the present food retail system is attributed to the fact that the majority of stores are too small to be efficient either in operation or as competitors of large stores.

Farm management in the Ozark region of Missouri, H. M. DIXON and J. M. PURDOM (*U. S. Dept. Agr. Bul. 941 (1921), pp. 51, figs. 16*).—This bulletin is based on the study of the organization and management of 79 farms distributed in five counties in the southern and southeastern Ozark region of Missouri. Thirty-one of these farms are representative of the conditions of rolling and hilly upland farms; the other 48 are situated in the valley and level uplands.

The data presented are for the year 1917. The season was good and prices of every article sold from the farms were higher than in previous years and more than compensated for increased expenses, so that conditions were favorable to a good labor income for the operators.

Topographical and climatic conditions together with transportation facilities in this region are described.

In summarizing the business of the rolling and hilly upland farms, they were placed in two groups, those with 40 acres or under in crops and those with over 40 acres in crops. The average size of the farms in the smaller-size group was 128 acres with 26 acres in crops and $3,832 capital, while the larger-size group averaged 240 acres per farm with 72 acres of crops and $7,133 capital. The valley and level-upland farms were classified in three groups, those with 40 acres or under, those with 40 to 70 acres, and those with over 70 acres in crops. The farms with 40 acres or under in crops averaged 29 acres in crops and had an investment of $4,631 per farm; those in the second group averaged 52 acres in crops and an investment of $8,937; while the farms in the third averaged 105 acres in crops with an average investment of $12,602.

The operators of rolling and hilly farms had in 1917 an average labor income of $309, and those operating farms of the second type, an average of $646. Of the 79 farms studied, 20 per cent had no labor income after making the usual deductions, and 21 per cent had a labor income above $1,000. The family income on the rolling and hilly farms averaged $759 and on the valley level-upland farms $1,331. It is indicated by this investigation that farms of the general live-stock type with less than 40 acres of crop land are generally unsuccessful.

Live-stock farming is the principal agricultural industry of this region, and the production and sale of cream is growing in importance. The average annual production per cow of 78 cows on 7 dairy farms was 142 lbs. of butter fat. The introduction of animals of greater productive capacity is recommended.

Losses of live stock on the farms for the year studied were as follows: Cattle 3.6 per cent, horses and mules 3.4, sheep 8.9, hogs 10.7, and goats 11 per cent.

It is suggested that pastures be improved, that auxiliary drought-resistant hay crops be grown, and that silage be provided for winter feed and for supplementing summer pasture.

Alfalfa, clover, soy beans, and cowpeas are grown in this region. Their importance both for hay and grazing is emphasized.

The labor income of each of the farms studied is graphically illustrated for the sake of comparison and detailed analyses are given of the business of 10 individual farms showing wide differences in organization and efficiency.

The horse and the tractor: An economic study of their use on farms in central Illinois, W. F. HANDSCHIN, J. B. ANDREWS, and E. RAUCHENSTEIN (*Illinois Sta. Bul. 231 (1921), pp. 171–224, figs. 22*).—Data on the cost and use

of horse labor and of tractors, based on cost-accounting and general-management studies carried on in central Illinois during the years 1913 to 1918, inclusive, are reported.

In the aggregate, detailed accounts are reported from 112 farms; that is, an average of 22.4 farms for each of the five years, 1913 to 1917. The records on the use of farm tractors were obtained mainly during the fall of 1918 by means of personal interviews with 100 farmers, each of whom had used his tractor one or more years. With but few exceptions, the horses used on the farms in the area studied ranged in age from 3 to 15 years and varied in weight from 1,300 to 1,500 lbs. They were kept primarily for draft purposes.

It was found that horse labor makes up from 30 to 40 per cent of all farm operating expenses in the corn belt, and is considered the one item above all others which can be profitably reduced by good methods of farm organization and operation. The total cost of horse labor on the farms under investigation in Hancock County during the years 1913–1918 was found to be made up in the following proportions: Feed 72 per cent, labor 11.28, interest 8.03, shelter 3.1, harness 3.44, and miscellaneous expenses 2.2 per cent. The average annual cost of keeping horses during the years 1913 to 1916, inclusive, on the farms studied ranged from $87.09 to $96.02 per horse. In 1917 it increased to $130.94 and in 1918 to $156.58.

It was found that reducing the cost of horse labor is effected by reducing the total carrying cost and by securing the largest possible amount of productive work per horse. Reduction in the total cost of carrying horses is effected mainly by (1) economical feeding, care, and management, (2) raising good colts, and (3) reducing depreciation charges. The largest amount of productive work per horse is secured mainly through (1) a farm sufficiently large, (2) crop rotations providing an even distribution of horse labor throughout the year, (3) production of two or more classes of live stock, (4) convenient lay-out of fields, and (5) classifying and scheduling of all farm work for the even distribution of horse labor throughout the year. Extreme variations in the distribution of horse labor throughout the year were found on representative farms, due largely to the difference in crop rotations practiced.

Approximately 25 per cent of the total labor performed on farms is classified as tractor labor, and the remaining 75 per cent as either nontractor or doubtful tractor labor. When only horses are used on a farm, the number required is determined by the peak load of labor, which, in the corn belt, occurs normally in the month of May in connection with soil preparation, corn planting, and cultivation. When a tractor is added to the equipment the number of horses required is determined by the peak load of nontractor labor, which occurs in June and July in connection with corn plowing, haymaking, and harvesting. It is estimated that farms using horses only, could, in general, displace 22.1 per cent of their horses if a tractor were added to the equipment, and under the most favorable conditions could displace 34.4 per cent. For the 100 farms studied in the tractor survey, the average horse displacement when the tractor was added was 20.6 per cent. The horse displacement effected by the 24 farms which made the best use of their horses and tractors combined was 33.1 per cent.

The principal advantage in the use of the farm tractor is considered to come through the actual displacement of horses. Of the 100 farms studied in the tractor survey, none reported increase in crop yield as an advantage secured by the use of the tractor. Relatively little saving in man labor was effected by the use of a tractor. It is concluded that on the average corn-belt farms, growing less than 240 acres of crop, horse costs can not be reduced enough to offset the cost of operating a tractor.

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Farm tenancy in Illinois (*Banker-Farmer, 8 (1921), No. 3, pp. 2, 3, fig. 1*).—This is the report of the Illinois Commission on Farm Tenancy, which held public hearings in February, 1920, in grain farming and live stock farming sections and sections where dairy farming and tenancy prevail. Its recommendations include (1) a transfer tax of 1 per cent of the selling price on all transfers made in less than one year after ownership is acquired in order to discourage speculation in land; (2) the reimbursement of the tenant on the termination of his lease for improvements put on the land, as well as protection for the landlord against unnecessary destruction of property by a careless tenant; (3) the enactment of necessary legislation to protect and promote second mortgage loans on farm land; and (4) an appropriation for the purpose of making a farm tenancy survey through the farm management department of the University of Illinois.

Discussion relating to inward and outward movement of agriculturists, A. L. Barkman (*Jour. Farm Econ., 3 (1921), No. 1, pp. 16–19*).—Tables showing respectively the inward and outward movement of alien agriculturists during the years 1913 to 1920, inclusive, total alien immigration and emigration during the period, the number of agriculturists who left the United States for Canada in 1920 stating that they did not intend to return within one year, the race of naturalized citizen agriculturists who left the United States during the year ended June 30, 1920, and the race of native-born agriculturists who departed during the same period, are given here with brief interpretive text. The material furnished the basis for the discussion previously noted (E. S. R., 44, p. 196).

A plan for reclaiming and peopling the mesa lands bordering the Imperial irrigation district, E. Mead (*California Sta. [Pamphlet], 1919, pp. 6*).—In these pages is published a letter setting forth the need for government financial support of irrigation works in this district. Objections are raised to certain proposed plans of sale of lands for subsequent development after irrigation works are completed, and a plan for setting aside certain territory as a State land settlement project is outlined.

The farm labor problem, D. D. Lescohier (*Jour. Farm Econ., 3 (1921), No. 1, pp. 10–15*).—This is a portion of the address previously noted (E. S. R., 44, p. 196).

Farm labor experience of the employment service of Canada, B. M. Stewart (*Jour. Farm Econ., 3 (1921), No. 1, pp. 20–23*).—The address previously noted (E. S. R., 44, p. 196) is published in these pages.

[Annual report of the Jewish Agricultural and Industrial Aid Society for the year 1920] (*Jewish Agr. and Indus. Aid Soc. Ann. Rpt., 1920, pp. 58*).—This report continues information previously noted (E. S. R., 43, p. 192).

Farming conditions in Guam, W. J. Green (*Guam Sta. Rpt. 1919, pp. 45–47*).—Brief descriptive notes, relating to crops and live stock produced and agricultural methods followed in this region, are given.

Cooperative grain marketing, a comparative study of methods in the United States and in Canada, J. M. Mehl (*U. S. Dept. Agr. Bul. 937 (1921), pp. 21, figs. 5*).—A history of the grain growers' organization movement in Canada and in the United States, with the establishment, in the first instance, of centrally controlled elevators of the so-called line-house type as distinguished from the single-unit type characteristic of farmers' elevators in the United States, wherein ownership and control is vested in a body of stockholders in the immediate surrounding community and which are operated as separate units independently of any other similar elevators, is outlined. The differences in the farmers' elevator movements in the two sections are attributed to the facts that in the beginning capital was not readily available at local points in

Canada and that farms were large and storage accommodations inadequate. Examples of organizations in the two regions are described.

It is said that the Canadian system of line-house operation would seem to offer greatest advantage in those States where crops are somewhat uncertain or where the crop year is short, under which conditions it may be difficult to secure the type of management necessary. Further, it is pointed out that Winnipeg, Can., is the gateway through which a large proportion of western Canadian grain is marketed each year and that terminal marketing activities tend to center there, while in the United States several large terminal markets exist.

The line-house method is said also to allow standardized construction and machinery, to make possible the closing of elevators in affected areas during periods of crop failure due to hail or drought or during dull periods, and to admit of centralized accounting systems. The local single-unit farm of cooperative elevators may be said to foster community pride and to function where a prejudice exists against centralized authority.

A digest of the Canada Grain Act, C. Birkett (*Farmer's Advocate and Home Jour., 55 (1920), Nos. 1463, pp. 1613, 1617; 1464, pp. 1658, 1659, 1674*).—A complete and concise analysis of the Canada Grain Act of 1912 with subsequent amendments, dealing with marketing of grain at country points, grain inspection, weighing of grain, terminal elevators, Eastern public elevators, and the Board of Grain Commissioners. Facsimiles of the various forms provided for in the act are included.

Uncle Sam's live stock grades, S. Bray (*Banker-Farmer, 8 (1921), No. 4, pp. 5, 6, fig. 1*).—The author describes the value of the producers' live stock reporting service of the Bureau of Markets, U. S. Department of Agriculture.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 3, pp. 25–36, figs. 4*).—The usual monthly estimates of acreage and condition of crops, stocks and farm value of important products, average of prices received by producers in the United States, and range of prices of agricultural products at important markets are given, together with United States and foreign crop summaries. The percentage of the season's total farm movement of wheat marketed between July 1 and the first of each subsequent month through a period of years, also the estimated quantity of wheat marketed, are charted. Prices of things farmers sell and buy are tabulated and charted, showing that one acre of crops had in 1920 only 67 per cent of the purchasing power of that in 1914. The merchantable corn crop of a series of years, trends in agricultural statistical data, value of plow lands, green bug and Hessian fly damage to wheat, and the quantity and value of cordwood consumed on farms in 1920 are subjects of special tabulations.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 11, pp. 161–176, figs. 4; 12, pp. 177–192; 13, pp. 193–208; 14, pp. 209–224*).—Abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given in these numbers covering the month up to about March 25. Light receipts and dullness seem to have been general in the markets during this period. Slight rises and declines are noted with reference to live stock and meats, other commodities declining or remaining fairly steady.

The world's cheese trade since 1913 is briefly outlined in No. 11. In No. 12, the city of Philadelphia is described in a special article as the third most important market of the United States for fruit and vegetables. In No. 13, the trade in kosher meats in New York City is described, and statistics are given showing the French importations of wheat with comparisons for the prewar period.

Statistical information relating to stocks, cotton, grain, provisions, live stock, seeds, crops, imports, exports, etc. of principal countries, 1920 (*Howard, Bartels & Co., Inc., Chicago, Statis. Inform. Stocks, Cotton [etc.], 1920, pp. 54*).—In addition to statistics of prices on the Chicago market, this publication gives brief reviews of how trading is conducted on the Chicago Board of Trade and reproduces official grain standards for wheat. Summaries of data for previous years and for a number of foreign countries are included.

Annual statistical report of the New York Produce Exchange for the year 1919 (*N. Y. Prod. Exch. Ann. Statis. Rpt., 1919, pp. 137*).—This continues information previously noted (E. S. R., 41, p. 294).

[Agricultural Statistics of Denmark] (*Statis. Aarbog Danmark, 25 (1920), 40–66*).—The annual statistics of land in cultivation and yields, numbers of live stock, and output of dairy products are given in these pages, continuing information previously noted (E. S. R., 43, p. 295).

[Agricultural statistics of Saxony] (*Statis. Jahrb. Königr. Sachsen, 43 (1916–17), pp. 99–114*).—Statistics given here covering acreage and yields of important crops and numbers of live stock resume reports previously noted (E. S. R., 35, p. 297).

AGRICULTURAL EDUCATION.

[Agronomy teaching in the State agricultural colleges] (*Jour. Amer. Soc. Agron., 13 (1921), No. 2, pp. 49–81*).—The following papers were presented at the thirteenth annual meeting of the American Society of Agronomy, held at Springfield, Mass., October 18, 1920:

Prerequisites for agronomy subjects, L. E. Call (pp. 49–53).—From a comparison of the curricula as shown by the most recent catalogues of 25 of the leading agricultural colleges and universities in this country, three classes were found as regards the requirement of prerequisites for agronomy: (1) Those that require no prerequisite and offer farm crops in the freshman year, (2) those that require general botany as a prerequisite and offer the work in the sophomore or junior year, and (3) those that require general botany and soils as prerequisites and offer the work in the junior year. These plans are briefly discussed. The author is of the opinion that for the best interests of all students the course in farm crops should be given in the sophomore year, and that general botany, with an agricultural trend, and chemistry should be required as prerequisites.

The standardization of courses in field crops, J. B. Wentz (pp. 53–59).—The author discusses the uniformity of work offered by similar institutions, the division of subject matter between the departments of a single institution, and the division of subject matter into courses within a department to prevent duplication of material. As regards the first of these phases, he presents a brief survey of course material in field crops now being offered. He finds 133 differently named courses in field crops which, if classified according to subject matter or content, are reduced to 47. Of these only 20 are offered by more than one or two colleges.

The first college course in field crops, W. L. Slate, jr. (pp. 59–63).—On the premise that there is a real science of field crops or a body of information that belongs to the subject, the author discusses the following problems of a first course called field crop production: Type, aims, and content of the course, together with the method of teaching, relation of the sciences and other courses, relation to the specialized courses in crops and to farm experience and high-school agriculture, place in the curriculum, and the amount of credit allowed.

The teaching of soils in agricultural colleges, W. H. Stevenson and P. E. Brown (pp. 63–70).—The status of the teaching of soils in a large number of

agricultural colleges, it is stated, seems to warrant the conclusion that more satisfactory results may be secured by uniting all phases of soil instruction in one organization or department. Failure to organize the work on this unit basis is due almost entirely, it is believed, to the attitude of teachers of pure science and of administrative officers. Basing the teaching of soils too largely upon the local experiments also sometimes interferes with the normal development of soils courses. Four important problems of soils teachers are briefly considered, viz, the number and sequence of courses and the amount of work in each, the subject matter presented in each course, the character and amount of laboratory work, and the general method of presenting soils instruction to students. It is concluded that no college can teach soils properly in two or even three quarter or semester courses, and that not less than four or five courses, of one quarter or term each, should be required in a four-year agricultural course for students majoring in farm crops, soils, animal husbandry, farm management, or horticulture. Some facts regarding the soils work at the Iowa State College of Agriculture and Mechanic Arts are given.

The teaching of soils, M. F. Miller (pp. 71–78).—This is a discussion of some of the findings of the conference of soils instructors at the University of Kentucky, June 23–25, 1920 (E. S. R., 44, p. 697).

The introductory course in soils, A. B. Beaumont (pp. 79–81).—The author calls attention to at least two schools of thought on the nature of laboratory work in soils for the so-called average four-year student who has only an average interest in soils, viz, those who would limit the laboratory work to operations which the student will be using, or at least which will be of direct value, in postgraduation activities, and those who would have the laboratory work include, in addition to the utilitarian exercises, those which may enlarge the student's vision and stimulate his interest. The possible value of the laboratory study of soils in an introductory course in acquainting the student with materials, teaching soil science, teaching the principles involved in soil investigations and in soil management, ascertaining definite information concerning specific soils, formal discipline, and in arousing and stimulating interest in soil science, are briefly discussed.

How to teach agriculture: A book of methods in this subject, A. V. Storm and K. C. Davis (*Philadelphia and London: J. B. Lippincott Co., 1921, pp. VII+434, pl. 1, figs. 222*).—This comprehensive text on methods is intended for teachers in service who are teaching agriculture in the one-room country schools, consolidated schools, high and normal schools, etc., for teacher-training students in colleges, and normal and high schools, for superintendents, principals, and supervisors, and others who are responsible for the supervision of the teaching of agriculture. It offers instruction on how to organize for and manage the teaching of agriculture; methods in the teaching of agriculture; how to teach agronomy, animal husbandry, dairying, poultry husbandry, horticulture, farm mechanics, engineering and shop work, farm management, the management of soils and fertilizers, in the classroom, laboratory, and field; how to conduct home projects and a land laboratory; how to equip for teaching agriculture; how to teach through charts, slides, and films, and organize an agricultural library; and how to conduct community work. Each chapter is followed by suggested exercises, and lists of agricultural textbooks for high schools, books and bulletins, aids in teaching agriculture, the agricultural experiment stations, American live stock record associations, etc., are appended.

Training teachers of secondary agriculture, C. R. Mann (*U. S. Bur. Ed., School Life, 6 (1921), No. 3, p. 5*).—In considering the minimum requirements for thorough professional training of teachers of secondary agriculture, the author discusses briefly (1) the need of instruction in rural economics, farm

management, and rural social problems, (2) the relative expensiveness of broad professional training, which he believes is warranted by the importance of the work, because of the proportional staff to number of students taking the work and the many professional courses required, (3) proper provision for practice teaching, (4) the effects on the character of the teaching in the technical departments of colleges, and (6) the necessity for mutual obligation in regard to this work among the States.

The scientific study of agriculture, P. HILLMANN (*Fühling's Landw. Ztg., 69 (1920), No. 7–8, pp. 121–130*).—The author outlines and discusses a suggested systematic reorganization of the agricultural course in the agricultural high schools and university institutes in Germany to comprise four semesters, each including 24 hours per week of theoretical instruction, for the training of practical farmers, and two additional semesters for the training of State agricultural officials, agricultural instructors, etc. He would devote the first two semesters to the study of eight fundamental subjects, viz, chemistry; physics; zoology; animal anatomy and physiology; botany, mineralogy, petrography and geology; political economy; and mathematics, drawing, construction, leveling, and surveying. The third and fourth semesters would include instruction in general agriculture, including plant production and agricultural engineering; special plant and seed production; general and special animal husbandry, including feeding and dairying; rural economics, including farm management, the history of agriculture, taxation, and bookkeeping; agricultural machinery; animal diseases; technology (fermentation and sugar industries); law and agricultural geography; horticulture; poultry; human hygiene; and forestry.

From 2 to 3 hours on five afternoons a week should be reserved for practical exercises and the evening hours (after 5 o'clock) for special lectures and general sciences. No lectures in agriculture and the natural sciences should be given in the fifth and sixth semesters during the day until 4 o'clock. This time should be reserved for work in the laboratories and in the institutes for political economy, farm management, training in the experiment field, etc., to attend special lectures at the university, the technical high school, and the oriental seminar (for colonial work).

The plan provides for a first examination at the close of the second semester, a diploma examination at the close of the fourth semester, and the doctor's examination on the completion of the six semesters. The author believes this plan will offer students a broader perspective than the present endless lecture system with few practical exercises, and that many more students will be attracted to the training for scientific work.

The new forest high school, K. KEMPF (*Allg. Forst u. Jagd. Ztg., 88 (1920), No. 24, pp. 153, 154; 26, p. 167; 27, pp. 172, 173*).—The author briefly outlines the instruction for a proposed specialized forestry high school, including instruction in the lumber industry and trade, and preceded by two or three year preparatory forestry schools in connection with intermediate schools, or a two-year preparatory course in the high school.

The organization of the forestry personnel and its training in Greece, C. G. SKLAWUNOS (*Forstwiss. Centbl., n. ser., 42 (1920), No. 12, pp. 443–450*).—An account is given of the development and present organization of the forest service of Greece, included since 1917 in the department of agriculture, and of the training of the forestry personnel.

Corn book for young folk, C. B. WILLIAMS and D. H. HILL (*Boston: Ginn & Co., 1920, pp. V+250, figs. 186*).—This text deals with corn growing and harvesting, corn silage, and storing the ears. Suggestions for the practical application of the lessons are included.

Farm horticulture, G. W. Hood (*Philadelphia: Lea & Febiger, 1921, 2. ed., rev., pp. VII+17–354, figs. 144*).—This is a second edition of this work, previously noted (E. S. R., 41, p. 96), with minor revisions and some rearrangement of the subject matter to conform more closely to the usual methods of horticulture.

A year's work in vocational agriculture: Horticulture, N. E. Fitzgerald (*Tenn. Dept. Pub. Instr. Bul. 3 (1919), pp. 34*).—This course comprises outlines of lessons on fruit growing, plant pests—insects and diseases, landscape gardening, farm forestry, and vegetable gardening. Suggestions with reference to the division of time, home projects, and library and laboratory equipment are included.

A year's work in vocational agriculture: Animal production (*La. Dept. Ed. Bul. 13 (1920), pp. 88*).—This course in animal husbandry for the even years of the eighth and ninth grades of Louisiana schools consists of (1) lessons on cattle, horses, swine, sheep, diseases and defects of animals, dairying, and poultry husbandry, (2) study outlines for pig, baby beef, dairy herd, egg production, and poultry raising projects, and (3) 106 laboratory exercises, of which at least 50 must be completed and recorded in individual notebooks in order to obtain credit. Lists of references to helpful literature and required laboratory equipment are included.

A unit course in poultry husbandry, C. H. Schopmeyer (*Fed. Bd. Vocat. Ed. Bul. 63 (1921), pp. 34*).—This outline of a unit course in poultry husbandry, intended for agricultural teachers and teacher trainers, suggests a year's work centered around the management jobs and jobs of operation involved in handling a small flock of poultry as a side line to general farming, or in poultry raising as the most important enterprise on the farm. Related subjects, classified for correlation, exercises, materials and supplies, and sources of information are included throughout the outline. The course is expected to be of special value in part time and evening class work in agriculture. Suggestive poultry survey forms and a system of accounting for the poultry enterprise are appended.

School and home cooking, C. C. Greer (*Boston: Allyn & Bacon, 1920, pp. XXI+530+3–24, pl. 1, figs. 95*).—This text consists of a study of body regulating, body building, energy giving, and health and growth promoting foods, flavoring materials, food combinations, food preservation, etc., together with related work comprising table service lessons, a consideration of the cost and food value of meals, food selection and buying, food requirements, infant feeding, diet for young children, food for the sick, home projects, and experiments in food preparation and composition and the processes of digestion.

Evening courses in home economics for Idaho schools, G. B. Elwell and K. S. North (*Idaho Bd. Vocat. Ed. Bul., 3 (1920), No. 4, pp. 19*).—Evening courses are outlined in the household budget; household management and housewifery, house planning, household furnishing and decoration, home health and nursing, garment construction, advanced dressmaking, tailoring, millinery, renovation, remodeling, laundering, food preparation, mother craft and child welfare, etc.

Type course of study for vocational home economics departments in negro schools, C. C. Helbing (*Baton Rouge, La.: Dept. Ed., 1920, pp. 16*).—The course outlined extends through two years and includes plain sewing, care of the home, cooking, and laundering in the first year, and dressmaking, millinery, crafts (such as rug and mattress making and basket weaving), advanced cooking, infant care and feeding, and invalid cookery in the second year. Five 90-minute periods a week for one term are given to each of the subjects.

Trade and industrial education for girls and women, A. L. BURDICK (*Fed. Bd. Vocat. Ed. Bul. 58 (1920), pp. 106, figs. 6*).—This bulletin treats of the economic and social aspects of vocational education for girls and women, and of ways and means of establishing and operating a program, including types of vocational schools and training agencies. A detailed synopsis of the contents of this bulletin and a classified bibliography on women in industry are appended.

Standards for judging agricultural club efficiency, W. W. CHARTERS and J. H. GREENE (*School Sci. and Math., 21 (1921), No. 2, pp. 116–121*).—In this study, based on the replies to a questionnaire received from 55 State club leaders, the authors find a startling lack of uniformity about the importance of items used in judging club efficiency. No unanimity was noted regarding the ends to be obtained by State leaders either in the individual States or in the Nation, although there was somewhat more agreement among leaders in the same State than among the different States. The authors conclude that the completion of the project and the making of a report are considered to be of most importance in general, while cooperative buying and club friendships are regarded as of the least importance.

Boys' and girls' club work, W. J. GREEN (*Guam Sta. Rpt. 1919, pp. 49, 50*).—The objects and rules governing the corn, copra, bean, taro, pig, and poultry clubs, which on July 1, 1919, had a total enrollment of 499, are briefly set forth.

MISCELLANEOUS.

Annual report of the director of the experiment station on work done under the Local Experiment Law in 1920, J. F. DUGGAR (*Alabama Col. Sta. Circ. 44 (1921), pp. 28*).—This includes a summarized report by the director of work in all departments conducted under this State law for 1920, a financial statement for the year, and detailed reports of heads of departments. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Georgia Station, 1920 (*Georgia Sta. Rpt., 1920, pp. 12*).—This contains the organization list, reports by the president of the board of directors and the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Guam Station, 1919 (*Guam Sta. Rpt. 1919, pp. 52, pls. 7*).—This contains reports of the animal husbandman in charge and the agronomist and horticulturist, and the extension agent, and meteorological observations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Illinois Station, 1920 (*Illinois Sta. Rpt. 1920, pp. 23, fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, brief notes as to the principal lines of work, and a list of publications of the year. Brief notes of progress in horticultural studies are abstracted on page 44 of this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 12, pp. 181–196, figs. 6*).—In addition to articles abstracted elsewhere in this issue, this number contains a brief article entitled Concerning Feedstuffs, by H. E. McNatt.

A classified list of projects carried on by the agricultural experiment stations, 1919 (*U. S. Dept. Agr., States Relat. Serv. [Pamphlet], 1919, pp. XIV+225*).—This multigraphed list has been noted editorially (E. S. R., 44, p. 1).

NOTES.

Alabama College and Station.—J. F. Duggar, director since 1903, retired from this position July 1 to become consulting agriculturist, a position in which more time will be available for study and writing on agronomy. D. T. Gray, chief in animal industry in the North Carolina College and Station, has been appointed director, beginning September 1.

The department of plant pathology, heretofore an independent department, has been made a division of the college and station department of botany.

California University and Station.—The appropriations of the State legislature for the ensuing biennium for instruction, experimental, and extension work in agriculture aggregated $2,500,000, an increase of 94 per cent over the previous biennium. In addition $400,500 was granted for buildings at the university farm at Davis, and $127,587.50 to complete the purchase of land and water rights for the proposed farm school at Riverside, as compared with an allotment of $30,000 in the previous biennium for a first payment for land and water rights at Riverside.

Dean Thomas Forsyth Hunt returned June 25 from a year's stay in Europe, spent in part at Rome as the delegate of the United States to the International Institute of Agriculture. Sabbatical leave for travel and study has been granted to W. T. Clarke, professor of agricultural extension; Thomas Francis Hunt, associate professor of agricultural extension; and R. S. Vaile, assistant professor of orchard management in the Citrus Substation.

Connecticut State Station.—The legislature has increased the biennial appropriation from $45,000 to $82,000. It has also appropriated $10,000 for investigations on matters connected with the production of tobacco. The station has secured an excellent field of about 13 acres where experimental work may be carried on along this line.

Delaware University and Station.—T. T. Martin, State leader of girls' and boys' club work, has resigned to accept a position with the Junior Achievement League with headquarters at Springfield, Mass. J. H. Clark (Purdue University, 1921) has been appointed instructor in horticulture and assistant horticulturist to succeed B. Davison, beginning July 1, and A. E. Tomhave (Pennsylvania State College, 1921) instructor in animal husbandry. In the division of rehabilitation in the school of agriculture, C. E. Phillips (Delaware University, 1921) has been appointed instructor in agronomy and Ray Koon instructor in horticulture.

Iowa College and Station.—According to a note in *Iowa Agriculturist*, H. D. Hughes, head of the farm crops department, has been granted a year's leave of absence to be spent with the Alabama Annual White Sweet Clover Growers' Association.

Kansas College and Station.—The State board of agriculture has accepted an invitation to hold one of its regular quarterly meetings each year at the station. About 20 State-wide agricultural organizations now hold one or more such meetings each year.

The first "Ag Fair" was held at the college May 3 by students of the division of agriculture. The fair contained educational exhibits from each of the departments of the division and a large number of amusement and carnival

features by the students. The receipts from the various small admission fees paid by the 6,000 people who visited the fair exceeded $2.000, a sum sufficient to pay all expenses of the fair and to provide a good surplus for future use by the Agricultural Students' Association.

The animal husbandry department is conducting a 3-year experiment, the chief object of which is to determine the respective value of alfalfa hay and silage as the sole roughage in a winter maintenance ration for steers which are kept on native pasture during the spring, summer, and autumn months. The experiment began in December, 1919, with 40 head of high-grade Hereford steer calves. The same animals are to be used throughout the 3-year period. They are pastured together during the pasture season each year and are divided into two groups for feeding each winter. During the winter, 20 of the animals (group A) receive alfalfa hay only, and the 20 others (group B) receive silage and cottonseed cake only. Each winter group A is divided into four lots which are used to test the feeding value of alfalfa hay cut at four different stages of growth, and group B is divided into two or more lots each winter and used to test the value of silage made from cane and corn, respectively, or of corn silage made by various methods. Individual weights are to be secured every 30 days throughout the 3-year period.

C. A. Herrick has been appointed research assistant in zoology in connection with parasitological investigations. J. H. Moyer has been appointed assistant in agricultural economics.

Massachusetts Station.—Dr. George H. Chapman, research physiologist, has resigned to accept a position with the Connecticut Valley Leaf Tobacco Improvement Association, with headquarters in Connecticut.

Minnesota University.—A fund to be known as the A. D. Wilson prize fund is being collected by subscription in honor of the retiring director of extension work. The income of this fund is to be used annually in either the college or school of agriculture or both as prizes to students excelling in studies having to do with cooperation and cooperative enterprises.

W. C. Coffey, professor of sheep husbandry in the University of Illinois, has been appointed dean of the department of agriculture, beginning July 1. F. W. Peck, farm economist in charge of cost accounting and farm management in the U. S. Department of Agriculture, has accepted an appointment as director of agricultural extension vice A. D. Wilson, whose resignation has been previously noted.

M. H. Fohrman, superintendent of testing, has resigned and has been succeeded by E. O. Hanson, the former superintendent. E. L. Holmer has accepted an appointment in the department of farm management at the Iowa College and has been succeeded by H. B. Price, instructor in marketing in Yale University. W. E. Hoffman has been appointed instructor in economic entomology vice W. C. Cook, resigned. J. S. Jones has resigned as assistant State leader of county agents and was succeeded April 1 by Frank L. Brown, county agent of Murray County. Genevieve Burgan, instructor in textiles and clothing, has been appointed assistant State leader of boys' and girl's work.

Mississippi College and Station.—Dr. E. Barnett has been appointed head of the department of animal husbandry, and C. J. Goodell animal husbandman in the station.

Nebraska University and Station.—H. P. Davis, head of dairy husbandry work in the University of Idaho and vice director of the Idaho Station, has been appointed chairman of the dairy department of the university and station, effective August 1.

New Hampshire Station.—P. R. Lowry of Ohio State University has been appointed assistant entomologist, vice C. R. Cleveland.

New Jersey Stations.—A conference of agricultural workers in institutions in the eastern States and executives of the fertilizer industry was held at the station June 2 and 3. The program included an inspection of the soil and fertilizer investigations and an automobile tour of the leading agricultural sections of the State. Twelve agricultural colleges and experiment stations were represented, as well as the U. S. Department of Agriculture, the Soil Improvement Committee of the National Fertilizer Association, and others.

Cornell University and Station.—Several acres of wooded hillside near the present biological field station have been presented to the university by J. T. Newman, an alumnus. The new tract will be kept as a wild-life preserve for research and study.

Glista Ernestine, the world's record Holstein-Friesian cow in the station herd, has completed her seventh record of more than 30 lbs. of butter fat in seven days. Her latest record is 31.4 pounds.

The department of plant breeding is distributing 4 strains of oats and 2 of barley among the farmers of the State for further redistribution in the future. The oats have been named Cornellian, Standwell, Comewell, and Empire, and the barleys Featherston and Crossman.

Dean and Director Albert R. Mann has declined an election as State commissioner of farms and markets. L. G. Graves, professor of dietotherapy for the past three years, resigned July 1 to become superintendent of dietaries and professor of dietetics in the training school of the Mount Sinai Hospital in New York City.

New York State Station.—The following resolutions were recently adopted by the faculty of Cornell University:

"On the occasion of the retirement of Dr. Whitman Howard Jordan from the professorship of animal nutrition in Cornell University and from the directorship of the New York Agricultural Experiment Station at Geneva, the members of this faculty desire to record their appreciation of the inestimable service which Professor Jordan has rendered to science and to the scientific agriculture of the State and of the Nation.

"Professor Jordan assumed the directorship of the experiment station in 1896, a critical time for agriculture and for the new experiment stations. He brought to his work true scientific training, gained as an undergraduate student at the University of Maine, as a postgraduate student at Cornell University under the guidance of Professor Caldwell, and as an assistant to Dr. Atwater at the Connecticut Agricultural Experiment Station; and long experience as a teacher of agriculture and agricultural chemistry at the University of Maine and at the Pennsylvania State College, and as director of the Maine Agricultural Experiment Station. With this wealth of training and experience, in addition to his high scientific ideals, his indomitable courage, his unflagging zeal for truth, his sound judgment in the selection of associates, and his unswerving loyalty to the best interests of agriculture, he has made a profound and lasting impression on the agriculture of this State.

"The outstanding feature of his long service in the interest of agriculture has been his strict adherence to the dictates of science without regard to popular esteem or favor. Strong as the temptation has been for an administrator to popularize the work of his institution at the expense of its research, Professor Jordan, in his administration of the station, has held strictly to the original purpose and object of the institution uninfluenced by considerations of popular favor. Under his wise and capable administration, the New York Agricultural Experiment Station has attained a leading position among the agricultural experiment stations of the world.

"Professor Jordan's connection with this college as professor of animal nutrition dates only from June 22, 1920, but his interest in the institution and his hearty and cordial cooperation have extended through all the 25 years that he has been director of the experiment station at Geneva. Accordingly there has always existed between these two institutions such close and gratifying cooperation in the prosecution of investigation and research that their work has ever been supplementary and unnecessary duplication of effort has been avoided.

"In spite of all the multiplicity of duties which naturally come to an outstanding figure in agriculture, Professor Jordan has always found time to continue his own scholarly work in animal nutrition and to advise critically with members of his staff on a wide variety of highly technical subjects. His keenly analytical mind, his sound judgment, his unusual administrative ability, and, above all, his lofty personal ideals and breadth of vision, have endeared him to his colleagues and associates. He has richly earned the relief which retirement from active service brings, and we, his colleagues, wish him many years in which to enjoy the privileges of the contemplative life which is now his."

F. R. Clark, a recent graduate of the University of Michigan, has been appointed assistant in research (horticulture) and has entered upon his duties. Henry L. Young, assistant chemist, resigned July 15.

North Dakota Station.—R. L. Webster, formerly of the department of entomology of the Iowa College and Station and just completing work at Cornell University for the degree of Ph. D., has been appointed station entomologist, beginning early in August. C. E. Mangels, chemist in charge of vegetable and fruit dehydration investigations of the Bureau of Chemistry, U. S. Department of Agriculture, has been appointed cereal chemist, beginning about July 15. G. W. McIlroy and N. B. Guerrant, 1921 graduates, respectively, of the University of Wisconsin and Westminster College, have been appointed poultryman and assistant in agricultural chemistry, beginning July 1.

Pennsylvania College and Station.—The resignations are noted of R. R. Welch, professor of dairy husbandry extension, effective July 1, and Martin M. Kloser, instructor in bacteriology, effective July 15. R. M. Gridley, assistant professor of animal husbandry extension, and C. L. Rumberger, assistant in agricultural extension, have been appointed county agents. E. M. Christen has been transferred from instructor in animal husbandry to instructor in animal husbandry extension. R. Irving has been appointed instructor in animal husbandry extension, B. Wright instructor in agricultural extension, B. J. Haler assistant in forestry, and P. Koenig assistant in agricultural extension.

Vermont University.—The university has been given a notable oil painting of the late Senator Justin S. Morrill, painted when he was about 65 years of age. During the last 20 years of his life and the 20 years following this painting hung in his Washington home. The portrait has been placed in Morrill Hall, together with a picture of the senator's only son, James S. Morrill, also deceased. It is stated that none of the senator's blood in line of direct descent is now alive.

Virginia Truck Station.—F. H. Keister, assistant horticulturist, was drowned June 5 while surf bathing at Ocean View. Mr. Keister was an alumnus of the Virginia Polytechnic Institute and had been connected with the station since graduation in 1919.

Necrology.—Professor John Hamilton, widely known for his long connection with the Pennsylvania State College and the farmers' institute work of the Nation, died at State College, Pa., July 5 at the age of 78 years.

Professor Hamilton was a native of Pennsylvania and served as sergeant-major of the First Pennsylvania Cavalry from 1861 to 1864. Following the

Civil War he was commandant of the cadets of the college from 1869 to 1873, business manager from 1874 to 1886, and treasurer from 1874 to 1911. He receiver the degree of Bachelor of Science from the college in 1871 and that of Master of Agricultural Science in 1872. From 1871 to 1880 he was professor of agriculture in the college, deputy secretary of agriculture of Pennsylvania from 1895 to 1899, and State secretary of agriculture from 1899 to 1903.

In the latter year he became farmers' institute specialist in the Office of Experiment Stations in this Department, continuing in this capacity until his retirement from active duties in 1914. His unfailing interest and faithful service in the cause of farmers' institutes, both in Pennsylvania and in the entire country, and as secretary for many years of the American Association of Farmers' Institute Workers, will long be remembered.

Jacob H. Arnold, agriculturist in the Office of Farm Management and Farm Economics, U. S. Department of Agriculture, since 1914, died at Takoma Park, D. C., July 12. Mr. Arnold was born in Defiance, Ohio, in 1864, and graduated from Grinnell College, Iowa, in 1891. After 13 years' service as professor of mathematics, economics, and history in Redfield College, South Dakota, he took up farm management work in Kansas, and following his appointment with this Department made some of its earliest farm management and cost accounting surveys. He was the author of a number of publications issued by the Department and a treatise entitled Farm Management, published in 1919.

A New Practical School of Agriculture in Southern France.—There has been established recently, under the patronage of the Agricultural Society of France, a new practical school of agriculture known as the La Félicité Higher School of Agriculture, near the town of Aix-en-Provence, 18 miles northwest of Marseille, where a tract of 247 acres of land has been secured. The object of this school is to give instruction in the scientific methods of agriculture in order to train young men to become farm managers or to direct colonial farming enterprises. The directors hope that a certain number of American students may eventually enter the institution.

The instruction will be given in two annual sessions of ten months each, and will consist of certain technical studies, usually given in the evening, and of six main practical courses, to each of which the student will devote three months, as follows: The cultivation of farm and pasture land; prairies, irrigation, and drainage; the culture of gardens, orchards, and vineyards; animal husbandry; rural engineering, including tractors, farm machinery and implements, and rural construction; and farm management, including the organization and direction of farm work, intensive and extensive soil culture, costs of production, agricultural technology (enology, distilling, sugar production, oils, the conservation of fruits, vegetables, and meats, butter and cheese making, and the making of fertilizers on the farm), agricultural accounts, rural economics (farm credits, marketing of products, insurance, agricultural syndicates, rural banks, cooperation, etc.), rural legislation, administrative and political economy, sociology, philosophy, and religion. Applicants for admission must be 16 years of age and have completed the ordinary French scholastic courses. A certificate is awarded on completion of the course.

Belgian Exchange Scholarships in Agriculture.—Through the efforts of M. Paul de Vuyst, Director General of Agriculture in Belgium, six scholarships of one year each have been offered to American students. These scholarships include one each in the Institutes Superior d'Agriculture at Gembloux and Louvain; one each at the Écoles d'Horticulture de l'État at Ghent and Vilvorde, and two for women at Berlaes-Lierres near Antwerp. These scholarships have been offered with the expectation that similar arrangements will

be made with the United States for an equal number of Belgian students. Additional details may be obtained from Editor of *World Agriculture*, Amherst, Mass.

Agricultural Education in the Orient.—It is planned to establish a second National University in China, with the greater part of Nanking Teachers' College as its foundation. The new institution will be located at Nanking, and it is hoped to open its doors this fall with a college of liberal arts and professional schools of agriculture, engineering, commerce, and education.

Press reports announce that the Maharajah of Bikaner, northwest India, has offered to convey to the Board of Foreign Missions of the Methodist Episcopal Church a tract of 10,000 acres of farm land as a site for an agricultural college and demonstration farm. The offer further includes the construction of all necessary buildings and payment of the salaries of the staff and operating expenses. It is stated that the offer will be accepted provided suitable agricultural experts can be obtained.

New Journals.—*Scientific Agriculture* has been established, beginning with January, 1921, as the official organ of the Canadian Society of Technical Agriculturists. The initial number deals quite largely with the organization and membership of the society, an account of which has been previously noted (E. S. R., 43, p. 401). It also contains numerous technical and popular articles on various phases of agricultural science. A French section, *La Revue Agronomique Canadienne*, issued as the official organ of the Société des Agronomes Canadiens, is appended to each number.

The American Journal of Hygiene "is to be devoted solely to the publication of papers representing the results of original investigation in the domain of hygiene, using the term in the broad sense to cover all applications of the mathematical, physiological, chemical, medical, and biological sciences to the problem of personal and public hygiene." At least six numbers, aggregating 600 pages, will be issued per annum. It is expected that provision will also be made for investigations of unusual length and interest in the form of Supplementary Monographs to be issued at irregular intervals.

Pysiological Reviews is announced as a new quarterly to be published by the American Physiological Society "to furnish a means whereby those interested in the physiological sciences may keep in touch with contemporary research." The journal is to consist of short comprehensive articles dealing with the recent literature in physiology, using this term to include biochemistry, biophysics, experimental pharmacology, and experimental pathology. Each article will be in the nature of a contemporary review of work, together with complete bibliographical lists, subjects being assigned by the editorial board.

The American Journal of Tropical Medicine is being published bimonthly as the official organ of the American Society of Tropical Medicine. The initial number contains the 1920 address of the president, Dr. Henry J. Nichols of the Army Medical School, a list of members of the society, and several original articles, including one on Natural Malaria Infection in Anopheles Mosquitoes, by W. V. King, of the Bureau of Entomology, U. S. Department of Agriculture.

Agricultural Engineering is being published as the monthly organ of the American Society of Agricultural Engineers. The initial number contained articles on Standardization of Farm Equipment, by R. Olney; Hardening Soft Center Steel Plow Shapes, by C. W. Rynders; Plantation Management from the Inside, by S. F. Morse; and several shorter articles, notes, etc.

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EXPERIMENT STATION RECORD.

VOL. 45. AUGUST, 1921. No. 2.

Many of the features now embraced in the subject of agricultural engineering have found employment in the art since early times. In a large measure the application of engineering in agriculture has increased with the advance of the industry, and in many instances it has been the primary cause of epoch-making progress. But as a recognized branch of agricultural teaching its organization is relatively recent, and as a subject of investigation it has not yet become widely established. In the latter respect it may be said to have lagged behind several related branches which are hardly of less fundamental importance.

The development of implements, machinery, and mechanical power to make man's efforts more effective and more productive is one of the most prominent features in progress; a better structure and more effective building and storage facilities are everywhere a mark of such progress. Add to these features the application of water to the soil where and when needed, its removal where present in excess, the subduing of land otherwise unfit for cultivation, and the provision of the facilities of the modern country home, and it will be evident what a large part rural engineering plays in the process of gaining and exercising dominion over the earth.

In recent years this branch has been steadily making its way, first as a teaching subject, then as a service branch, and gradually taking its place in the field of investigation. This latter development is not only logical, but is one of the features which at the present time are deserving of special encouragement. There can be no question that the purely mechanical and rule-of-thumb methods which have been followed need to be subjected to the same rigid scrutiny that other branches of farming have received. That the opportunity is open hardly needs argument. It is already recognized that tools and implements built and operated without mechanical or mathematical precision often embody undesirable features such as lost motion, wasted energy, or lack of durability or reliability, and in some cases are not fully adapted to the needs sought. Indeed these ends are themselves not always clearly understood. Building and storage structures planned and erected without consideration for warmth,

light, and ventilation, to say nothing of strength and durability, have proved uneconomical and inadequate. They do not take account of the advances which science has taught in the storage of crops, the housing of stock, and the care of dairy animals. Thus in order to keep abreast of the times it has become necessary to seek out and apply engineering principles in the development of the mechanical, electrical, hydraulic, and other engineering processes involved in modern farming, and to adapt these to the modern teaching of agricultural science.

In the beginning of agricultural engineering old and well established engineering principles were naturally applied as far as possible, but it soon developed that the problems of agriculture requiring engineering treatment are more or less specialized. They present conditions and requirements which are of a special nature, which have to be taken into account. This brings out the advantage of the agricultural outlook and contact, and at the same time it presents the opportunity for investigation immediately adapted to the situation. Certain of the engineering principles and formulas originally used are found to need intelligent modification or development, and again new facts and special information must be established to meet the requirements in many special cases.

While considerable progress has been made in providing a broad background and to some extent in the formulation of purely agricultural engineering principles, the development of inquiry along advanced lines has been relatively limited, and there is a feeling among some that this branch has not kept pace with the rapid advance in other branches of agricultural science. It is undoubtedly true that, from the nature of the situation, considerable of the activity in agricultural engineering has consisted of teaching, extension, and expert service, rather than a searching after and disclosing of new information. The fact that there is a demand for the former is proof that at least some of the latter should be developed, to lead the way and stimulate gradual advancement in the subject. This will require opportunity—not only facilities, but time and freedom and a sustaining support which will encourage and give protection. Manifestly in a new subject like this various types of activity will be needed, just as they have been in horticulture and agronomy and other branches. It will be useful to make comparative trials, to apply known facts and principles in designing appliances and structures, to employ the skill and judgment of the engineer in a variety of ways to matters which have a bearing on agriculture; but without losing sight of the agricultural connection or purpose, a certain amount of investigation or carefully considered research will be a means of growth and enable rank to be taken with other departments of agricultural science.

A survey of the project lists of the experiment stations shows a relatively small number of projects in the field of engineering. The majority of these are rather elementary, relating to design of structures, comparisons of implements or methods, surveys for engineering enterprises, and the like. There is no intention, of course, to disparage any of these, but the record shows very few projects of actual research grade. As a matter of fact, no project in agricultural engineering has ever been submitted for the Adams fund, a fact which, although it does not necessarily indicate the absence of such projects, suggests that the field has attracted but little attention.

Research is often used in a rather loose and broad sense. It may very properly be reserved for types of effort which, besides being systematic aim at something more than comparisons, involving originality in procedure or in the end product, and as a rule resulting in facts rather than in material things. It is well to maintain these distinctions in agricultural engineering. Standards, of course, advance with the progress of the subject, and what is recognized as research at one stage will lack the essential qualities at a later stage because of the progress which others have made. It will be well to recognize research in agricultural engineering as the pursuit of knowledge having a basis in science, not merely the means of testing or perfecting a particular mechanical device. It aims to consider all the factors and principles involved and the purpose sought to be accomplished, as well as the mechanical ingenuity involved in the product. It must naturally take into account the purpose which is to be accomplished by the appliance or operation, and this often brings engineering research into intimate relation with other branches of agricultural science. Progress is the watchword of research, and research is the basis of advancement of any branch of pure or applied science. Unless agricultural engineering can be developed as a research subject, it will lag behind, will borrow its fundamentals from physics, chemistry, agronomy and other branches, and will be in danger of remaining largely a service department occupied with the application and adaptation of what is known and its teaching. To secure a certain degree of independence and to grow of its own effort, the subject ought to have the elements of growth within itself, and these need to be visualized and set in motion by leaders in that field.

The formation of the American Society of Agricultural Engineers was a recognition of the position this subject has attained and the need of organized means for advancement. It has given a decided impetus to investigation in that line and has tended toward the development of methods and the setting up of standards.

For several years the society has had a research committee which has been engaged in determination of the status of scientific informa-

tion, the analysis of needs for research, and the formulation of methods of procedure in the plan and execution of specific projects. This study has developed a considerable record of inquiry extending back for a quarter of a century, from which has been derived a considerable part of the basic facts and principles upon which present knowledge of agricultural engineering rests. Some of the hydraulic formulas used in irrigation and drainage are illustrations of the results of this work, and it is also reflected in the development of certain farm machinery and other appliances.

The study has also disclosed a large amount of simple testing and experimentation resulting in data for the most part of rather limited application and less permanent value. This is particularly true in the case of certain matters relating to rural sanitation, and in the farm machinery field much of the experimentation has been of relatively limited fundamental character in proportion to the importance of the subject and the opportunity offered. It is found that too often such work has apparently lacked definiteness of plan and fundamental aim, or has been conducted to meet a superficial need rather than to derive broad general facts. The character and the paucity of the work in some directions, it is believed, has tended to retard the progress of agricultural engineering as a teaching subject and along applied lines.

One important feature in the development of investigation in such a subject is a survey of the field in order to determine the most desirable lines along which investigation should be conducted at the present time and to provide bases from which to operate. Such a survey naturally deals largely with the available scientific information and the technical and economic conditions involved. It thus opens up avenues for profitable inquiry and directs attention to the types of problems and the character of work especially needed.

This the research committee of the society, working in connection with the college section of that organization, has for some time been engaged in, and has brought forward some fifty specific lines along which investigation and experiment are deemed desirable. The subjects embraced include all of the main branches of agricultural engineering, and have been selected as the most pressing and the most representative of agricultural interests throughout the United States. The work of the committee has not only established the need of determining underlying facts and principles in a number of lines and establishing the influence of prevailing conditions, many of which are now more or less speculative in character, but it has pointed to the importance of planning and executing projects with a definite aim in each instance.

Inquiry in this subject, as in all others, must be planned and conducted with vision and understanding of the real nature of the

problem to be solved. Unless this is done the end sought may not be a profitable one or the work may be of purely tentative value. For example, it would be well-nigh useless to derive a formula for a plow moldboard until it was scientifically clear what a moldboard was designed to accomplish in a given soil or for a certain purpose. The purpose sought to be accomplished is the proper starting point in designing, perfecting, or testing an implement; but it will be recognized that it is a point frequently neglected, with the result that the planning is faulty and the results give divergence of opinion. There is a profitable field for study of the theoretical basis of plowing, and such a study would involve a group of several agricultural specialties.

The complex nature of the problems in agricultural engineering emphasizes the need of the same broad preparation and inculcation of the research spirit which prevail in other lines of advanced inquiry. There is need in that subject of understanding which rests on principles and the relation of conditions, as well as the requirement of facts and skill and ingenuity. In the training of agricultural engineers stress is naturally laid on ability to do things, to apply rules, to be resourceful in meeting specific conditions effectively. Attention is less rarely given to training in the acquisition of knowledge which is new, in questioning the reason for a process, or raising a doubt as to an empirical fact. The difference between experience and sound practical judgment on the one hand, and investigation directed toward the establishment of new scientific facts or a better understanding of principles and relationships on the other, is as great in agricultural engineering as it is in agronomy or animal feeding; and the development of the proper attitude is as essential to success in engineering research as it is in any other branch of scientific or technical inquiry.

The requirements for successful investigation are somewhat different from those of engineering practice. The planning and execution of scientific inquiry calls for the exercise of vision, the knowledge of the means of solving scientific problems, and the spirit which demands to know the meaning of the fact as well as the bare fact itself. Hence the individual engaged in the planning and execution of research in agricultural engineering needs not only to be trained in engineering matters but to be trained in research, its methods and spirit as well; he needs to have both the time and the patience for his investigations to make them thorough and searching.

The strengthening of investigation in this field will call for the formulation in their research aspects of some of the things which need to be done. If there are problems to be solved which depend on more fundamental inquiry, on the development of methods which will give more trustworthy or more intimate knowledge of the facts and

conditions involved, it should be possible to formulate these so that they will stand out with force, and thus to open up the field. The setting forth of the real nature of the questions which come to the engineer will serve to illustrate best of all the essential features involved in scientific inquiry and will prepare the way for leadership in developing the field. Some of these problems will be so broad in their fundamental character that they will require the help of specialists in other lines, and will thus lead to cooperation; in this the engineer need not play an incidental part, but ought to be able to contribute something which none of the other specialists can.

The American Society of Agricultural Engineers has a highly useful function in guiding and stimulating inquiry and in paving the way for cooperation. It represents a viewpoint which should serve to bring out important questions likely to be overlooked by specialists in other branches. It can emphasize the importance of engineering being taken into account in connection with various other problems of a comprehensive nature. Already the society is attempting to establish better cooperative relations between Federal and State agencies, between institutions in different States, and between the agencies within individual States which have common interests in agricultural engineering questions. On the basis of topics which its survey has shown to be important it will develop plans of procedure which will be subjected to the critical scrutiny of its committees and of the society as a whole. Such an organized effort as this is of no small interest to the agricultural experiment stations, many of whom are represented in the society, and it will likewise be of much interest to station directors in setting forth the field and the desirability of development in that line of inquiry.

The provision thus far made for investigation in agricultural engineering at most of the experiment stations is relatively small. In the majority of cases the engineers are largely engaged in teaching and extension work, or in designing structures or plans to meet the needs of applicants. The actual experimental work occupies a rather subordinate position, in spite of the fact that both the teaching and extension work depend largely upon the results of research for their progress and development. The result is that the engineer does not have the opportunity and is not always given the encouragement for digging deep and supplying an increasingly broad and strong foundation for his speciality. This may sometimes be due to his own inclinations or preferences and sometimes to the conditions under which he works, but until both the need and the ability are shown for more fundamental investigation in engineering support may be relatively slow to materialize.

There is undoubtedly opportunity and need for a type of study which will go beyond comparisons, will attempt to trace the true relation between conditions and results, will make engineering as applied to agriculture less empirical and rest it in a larger measure upon facts and principles which it is itself helping to establish. It is recognized, of course, that for a time at least much of the work of the agricultural engineer must of necessity be of rather elementary nature and immediately practical aim, and will rest in considerable measure upon his general information, mechanical ability, and practical qualities. But if this specialty is to grow it must be through research which is searching and severe, and the department must not be exclusively a teaching and service department or restricted wholly to practical affairs.

This will require that agricultural engineers be given the same consideration as other branches of agriculture in the provision of funds and facilities. Both men and opportunity will need to be provided. In general, perhaps, the specially trained personnel will not be forthcoming until the opportunity presents an attractive field. In some instances it may be necessary to train men in part, or to adapt specialists to this field in order to work out certain types of problems. The opportunity for leadership both in planning and in execution would seem to be a large one.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Yearbook of chemistry, edited by R. MEYER (*Jahrb. Chem., 24 (1914), pp. XI+478; 25 (1915), pp. XII+454; 26 (1916), pp. XII+481, fig. 1; 27 (1917), pp. VII+272; 28 (1918), pp. VII+267, figs. 2*).—These volumes contain reports of the progress in pure and applied chemistry for the years 1914–1918, inclusive, in continuation of the series previously noted (E. S. R., 32, p. 801).

Popular chemical dictionary, C. T. KINGZETT (*London: Baillière, Tindall & Cox, 1920, pp. VI+368, figs. 76*).—This dictionary contains definitions and explanations of chemical laws and processes, descriptions of the chemical elements and the more important inorganic and organic compounds with their preparation or manufacture and applications, and illustrated descriptions of various chemical apparatus.

Chemical French, M. L. DOLT (*Easton, Pa.: Chem. Pub. Co., 1920, 2. ed., pp. VIII+413*).—A few minor changes, corrections, and additions have been made in this revision (E. S. R., 39, p. 418).

Laboratory manual of elementary colloid chemistry, E. HATSCHEK (*London: J. & A. Churchill, 1920, pp. 135, figs. 20*).—This manual gives detailed directions for carrying out the fundamental operations of colloid chemistry, and for making a number of representative preparations and examining them by the standard methods.

Chemistry and the food industry, C. L. ALSBERG (*Chem. and Metall. Engin., 23 (1920), No. 21, pp. 1005–1007*).—This is a brief discussion of various chemical problems relating to the industries that use agricultural raw materials.

The chemistry of succulent plants, K. BRANHOFER and J. ZELLNER (*Hoppe-Seyler's Ztschr. Physiol. Chem., 109 (1920), No. 1, pp. 12–15*).—In this paper, which supplements a previous contribution by Zellner (E. S. R., 40, p. 710), analyses are reported of the leaves of several succulent plants, including *Sedum telephium, Sempervivum hirtum, Euphorbia coerulescens, Opuntia monacantha,* and *Aloe vera.*

The results in general confirm the earlier observations of a low content of iron and a high content of water-soluble material, calcium malate, and reducing sugar, although the latter was almost completely absent in Opuntia. A low nitrogen content did not prove to be the rule. A point not brought out in the previous study is the almost complete lack of tannin in all of the plants examined.

Continuation and extension of work on vegetable proteins, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 389–401*).—This is the annual progress report (E. S. R., 43, p. 409) of work on vegetable proteins and vitamins, the detailed reports of which have been previously noted from other sources.

The chemistry of enzym actions, K. G. FALK (*New York: Chem. Cat. Co., Inc., 1921, pp. 136*).—This is the first of a series of scientific and technologic monographs on chemical subjects to be published under the auspices of the American Chemical Society.

The method of treatment adopted by the author is essentially a discussion of the progress which has been made in the investigation of enzyms along the lines of the kinetics of enzym action and the study of enzyms as substances possessing definite chemical structures or configurations. Throughout the book it is emphasized that enzyms "are to be considered as chemical substances which obey the laws of chemistry and whose actions are explainable by the theories in vogue." The last 2 of the 10 chapters into which the book is divided deal with the uses and applications of enzyms and a general summary of the present status of the enzym problem.

Chemical investigation of amylases and related enzyms, H. C. SHERMAN (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 338–340*).—This annual progress report of investigations of amylase and related enzyms (E. S. R., 43, p. 311) includes a brief report of an extension of the study of the effects of amino acids upon the enzymic hydrolysis of starch (E. S. R., 42, p. 203) to glycin, alanin, phenylalanin, and tyrosin. The data reported for these four amino acids show a general similarity to the previously reported data for asparagin and aspartic acid.

"Allowing for divergences attributable to experimental error, it appears that the effect of amino acid in facilitating the enzymic hydrolysis of starch is similar, but not necessarily identical, for the different amino acids thus far investigated; that it is somewhat greater for the purified form of the enzym than for the natural or commercial material in which the enzym is accompanied by other constituents of the tissue or secretion in question; and that it is greater for the pancreatic and salivary amylases than for the amylases of malt and of *Aspergillus oryzae*. In general, the addition of a mixture of two amino acids gives practically the same effect as would result from a corresponding concentration of one of them."

In discussing the nature of this effect evidence is furnished that the favorable influence may be due partly to a protection of the enzym from deterioration in the aqueous dispersions in which it acts. Evidence is also furnished that amino acids are effective in protecting the enzym from the deleterious action of an inhibitory agent such as copper.

"In addition to protecting the enzym from gradual deterioration under the influence of the water in which it is dispersed, or from inhibition by certain actively deleterious substances if present, amino acids may or may not literally activate the enzymic hydrolysis by directly facilitating or accelerating the interaction of enzym and substrate, or they may function by sustaining the activity of the enzym through combining with some product or products of the enzym action, which products might otherwise combine with the enzym itself, thus reducing its activity, or might if remaining free in the solution tend to bring the hydrolysis to equilibrium. Experiments designed to throw further light upon these points are now in progress."

Methods of analysis and laboratory control (*Denver: Great West. Sugar Co., 1920, pp. VI+259*).—This reference book, prepared for the laboratories of the Great Western Sugar Co., includes directions for the process control of beet sugar manufacture, and methods for the analysis of raw material and sugar house products and for foods and feeding stuffs, cottonseed cake, and soils. Several of the methods in the latter group are those of the Association of Official Agricultural Chemists.

Standards and tests for reagent chemicals, B. L. MURRAY (*New York: D. Van Nostrand Co., 1920, pp. X+385; rev. in Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 1035, 1036*).—This reference book on the more important reagents used in factory and other laboratories deals with about 300 substances. The formula, molecular weight, important properties, maximum limits of im-

purities, and methods of testing these substances are given, together with valuable information concerning precautions to be taken in storing and dangerous and unpleasant properties of certain of the substances. Several useful tables are appended, including the percentages of different acids corresponding to the specific gravity of their solutions.

A study of some biochemical tests.—II, The Adamkiewicz protein reaction. The mechanism of the Hopkins-Cole test for tryptophan. A new color test for glyoxylic acid, W. R. Fearon (*Biochem. Jour., 14 (1920), No. 5, pp. 548–564*).—In this paper, which is the second of a series of studies of biochemical reactions (E. S. R., 40, p. 114), a new color test for glyoxylic acid is described, depending on its action with pyrogallol in the presence of H_2SO_4 with the formation of a deep blue color. Under the same conditions aliphatic aldehydes give various shades of red. By means of this test it is shown that the Hopkins-Cole test for tryptophan is due to glyoxylic acid and the Rosenheim test to formaldehyde.

Salicylic aldehyde in a 10 per cent solution in alcohol is suggested as a simple quantitative reagent for tryptophan and the indols. On warming a mixture of the substances to be tested and strong HCl with a few drops of the reagent, followed by a drop of 10 per cent hydrogen peroxid, an intense blue color is formed with tryptophan, a deep purple color with scatol, and a bright carmine with indol. The color is said to be produced with less than 0.1 per cent of tryptophan.

The paper also includes a brief discussion, with suggested formulas, of the condensation derivatives of tryptophan which make up the pigments.

Microreduction methods, D. G. C. Tervaert (*Hoppe-Seyler's Ztschr. Physiol. Chem., 110 (1920), No. 1, pp. 41–54*).—The author discusses the Bang micro method for the determination of blood sugar and the potassium dichromate method for the determination of blood fat or lipoids (E. S. R., 41, p. 116), and describes an application of the latter method to the determination of glucose, lactose, and maltose. The technique is as follows:

The equivalent of from 0.2 to 0.4 cc. of a 1 per cent solution of the sugar to be tested is mixed in a 100 cc. Erlenmeyer flask with 1 cc. of N/20 potassium dichromate and water to make a volume of 6 cc. Four cc. of H_2SO_4 is added and the flask heated on the water bath for 30 minutes, after which it is cooled, and 50 cc. of distilled water and 1 cc. of 5 per cent potassium iodid solution are added. After standing a minute the solution is titrated with standard thiosulphate. The difference between the titration value and that of a blank treated in the same way gives the reducing value of the solution.

Values obtained for the reducing sugars in blood by this method are higher than with the copper method. Added sugar is quantitatively recovered from the blood.

The quantitative determination of selenium, F. Wrede (*Hoppe-Seyler's Ztschr. Physiol. Chem., 109 (1920). No. 6, pp. 272–275*).—The method recommended by the author consists in the oxidation of the substance in the presence of platinum as a catalyzer and the titration of the selenic acid thus formed with N/100 NaOH, using methyl orange as an indicator. In determining sulphur in the presence of selenium the total acidity is titrated and the H_2SO_4 then determined gravimetrically as barium sulphate. The difference between the total acidity and the acidity calculated from the $BaSO_4$ represents the selenic acid. In the presence of nitrogen or the halogens the selenic acid, instead of being titrated, is reduced with sodium sulphite in strong HCl solution and determined gravimetrically.

The method, the technique of which is described in detail, is said to require only very small amounts of material and to be quite rapid of execution.

Mustard oil as a preservative of milk, P. Post (*Pharm. Weekbl., 58 (1921), No. 5, pp. 131–138*).—Mustard oil in the proportion of 20 drops to 1 liter of milk is suggested as a preservative for milk samples to be used for analysis. Experimental data are presented which indicate that the addition of the oil has no effect on any of the customary determinations except freezing point, lactose, protein, and catalase. Correct results may be obtained in freezing point determinations by shaking the sample with 10 per cent of sesame oil and in the lactose determinations by shaking three times with petroleum ether. By adding to 10 cc. of the milk 5 cc. of alcohol and evaporating to a final volume of 5 cc., the mustard oil is driven off and correct protein determinations can be made. Catalase is destroyed by mustard oil, so that catalase determinations can not be made on milk samples to which this has been added.

Factors influencing coagulation temperature in evaporated milk, L. A. Rogers (*Canner, 52 (1921), No. 10, pp. 165, 166, figs. 3*).—The author, from the Dairy Division, U. S. Department of Agriculture, discusses the conclusion drawn by Sommer and Hart (E. S. R., 42, p. 208) that the chief factor in the heat coagulation of fresh milk is the composition of the milk salts. He shows that, while this may be true of fresh milk from individual cows, in herd milk other factors enter in which have so great an influence on the curdling temperature that the effect of the composition of the salts is almost entirely obscured. Of these factors the most important is considered to be the growth of bacteria, not only of acid-forming types but of types which produce a rennin or milk-curdling enzym without increasing the acidity of the milk. Experiments are cited in illustration of the points brought out.

The iodometric determination of copper and its use in sugar analysis, P. A. Shaffer and A. F. Hartmann (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 349–390, figs. 4*).—Two papers are presented.

I. *Equilibria in the reaction between copper sulphate and potassium iodid* (pp. 349–364).—In this paper are reported the results of a determination of the points of equilibria of the reaction

$$CuSO_4+nKI=CuI+I_2+K_2SO_4$$

at ratios of from 1 to 10 KI : 1 $CuSO_4$ at various dilutions with a view to the utilization of the reaction for the accurate determination of either cuprous or cupric salts. The procedure consisted in mixing the solutions of $CuSO_4$ and KI in definite molecular ratios at widely varying concentrations, and after standing at room temperature pipetting samples of the supernatant liquid directly into an equal volume of water containing an excess of NaOH to precipitate the cupric copper. This was removed by filtration and the iodin determined by acidifying the filtrate and titrating with thiosulphate. The experimental data thus obtained indicate that for the determination of cupric salts potassium iodid must be added to give a final concentration of about 0.25 M (4 to 5 gm. per 100 cc. of solution). For the determination of cuprous salts the solution must be so diluted that the final concentration of copper and of iodid does not exceed about 0.005 M each.

It is noted that the conditions found empirically by Gooch and Heath[1] for cupric salts and by Maclean (E. S. R., 41, p. 505) and Scales (E. S. R., 34, p. 611) for cuprous salts comply with these requirements.

II. *Methods for the determination of reducing sugars in blood, urine, milk, and other solutions* (pp. 365–390).—It is pointed out that the method of titration of cuprous copper as noted above is limited in its usefulness on account of the extreme dilution required, and attention is called to the possibility of reducing the concentration of cupric ions to a negligible value by the addition of alkaline

[1] Amer. Jour. Sci., 4. ser., 24 (1907), No. 139, pp. 65–78.

oxalates, thus enabling one to direct the reversible action to completion in either direction at will. The cupric salt is first completely reduced and precipitated as cuprous iodid in the presence of a large excess of soluble iodid and the liberated iodin reduced to iodid on titration with thiosulphate. On the addition of more free iodin and potassium oxalate the cuprous iodid is at once dissolved and oxidized by the free iodin, and is not affected by the removal of the excess of free iodin in a second titration with thiosulphate. This makes it possible to determine the amount of copper reduced by sugar either by "cupric titration," the method based upon the determination of the residual cupric salt by its reaction with an excess of KI, or by "cuprous titration," the determination based upon the reoxidation of cuprous salt by iodin made possible by the action of the alkaline oxalate.

The technique is described in detail for the two procedures as applied to the determination of large amounts of reducing sugar and of small amounts as in milk, blood, and urine.

The iodometric estimation of sugars, J. L. Baker and H. F. E. Hulton (*Biochem. Jour., 14 (1920), No. 6, pp. 754–756*).—The authors confirm the conclusion of Judd (E. S. R., p. 507) that the method of Willstätter and Schüdel for the iodometric estimation of sugar yields good results. In practice it has been found necessary to employ an excess of iodin and alkali beyond that required by the equation and to mix the reacting solutions in the order of sugar, iodin, and alkali. It has been found possible to reduce the time required for the reaction from the 20 minutes originally recommended to 5 minutes. Attention is called to the fact that proteins are oxidized by iodin, and that if the method is to be used for the analysis of solutions other than pure sugars, the disturbing effect of proteins and other impurities will have to be considered.

The analysis of maple products.—II, The composition of maple sirup and of maple sugar sand and the detection of adulteration of the sirup, J. F. Snell (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 13 (1919), Sect. III, pp. 221–231*).—This summary of the results of investigations of the author (E. S. R., 35, p. 416) and others on the composition of maple products and their adulteration has been essentially noted from another source (E. S. R., 44, p. 414).

The determination of sodium in blood, E. A. Doisy and R. D. Bell (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 313–323*).—For the determination of sodium in blood the authors make use of the method of precipitation with cesium bismuth nitrite described by W. C. Ball,[2] the complex sodium cesium bismuth nitrite being capable of precipitation from as small an amount of sodium as 0.01 mg. in final volume of 2 cc. The technique of the method is described in detail, using gravimetric, volumetric, or colorimetric procedures for the final estimation of the nitrite. The colorimetric estimation is based on the coupling reaction of the nitrite with naphthylamin and sulfanilic acid, and the volumetric on the oxidaton to nitrate on titration with standard potassium permanganate. The volumetric method is preferred by the authors as being of greater speed and accuracy.

Tables are given showing the sodium content of normal urine and of beef and swine blood as determined by this method.

Apple candy, a commercial use for cull apples, T. H. Abell (*Utah Sta. Bul. 179 (1921), pp. 3–14, figs. 6*).—Following the suggestion of James (E. S. R., 39, p. 16) that a palatable candy-like product can be made from apples by drying thin slices mixed with sugar, the author has developed a method of treatment which is said to yield a very satisfactory product.

The method consists in grinding in a food chopper previously washed, peeled and cored apples, adding granulated sugar in the proportion of 15 lbs. to 100

[2] Jour. Chem. Soc. [London], 97 (1910), II, pp. 1408–1414.

lbs. of the chopped apples, spreading the mixture in thin layers on drying trays and evaporating for from 36 to 48 hours in a tunnel-type evaporator at a temperature of from 90 to 120° F. The dried product, known as apple leather, can be stored as such or ground in a food chopper, the resulting product being known as apple paste. In making the so-called apple candy a sirup made from 3 lbs. of sugar and 1 qt. of water is stirred into 4 lbs. of the dry apple paste and the product molded into any desirable form and allowed to harden slightly before use. This process is considered practical for the utilization of small blemished apples which would otherwise not find a market.

The soy-bean problem, D. M. ADKINS (*Sci. Prog. [London], 15 (1921), No. 59, pp. 445–451*).—A popular article on the utilization of the soy bean and its by-products.

To make olive oil at home, C. H. BEAUMONT (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 489, 490*).—Directions are given for the home manufacture of olive oil on a small scale.

METEOROLOGY.

On the possibility of forecasting the summer temperature and the approximate yield of rice for northern Japan, T. OKADA (*Japan Bul. Cent. Met. Observ., 3 (1919), No. 1, pp. 19–32, pl. 1; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 11 (1920), No. 2, pp. 148–150*).—It is pointed out in this article that in northern Japan the yield of rice is determined by the general summer temperature, especially that of August, a uniformly high temperature with abundance of sunshine during this month insuring a good rice crop.

The author attempts to find a basis for forecasting the summer temperature of northern Japan in the correlation between these temperatures and the barometric variations observed in March at Zikawei, China, and Miyazaki, on the southeastern coast of the island of Kiushiu, and during March to May at Santiago, Chile, and Buenos Aires, Argentina. He shows a positive and strong correlation between barometric variations at these places and summer temperature in the north of Japan, and concludes from this fact that a poor rice crop in northern Japan is preceded in most instances by a very low barometric pressure over South America during the period March to May and by a very slight gradient during March at the two other places named.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. W. POOLE (*Massachusetts Sta. Met. Buls. 387–388 (1921), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

Meteorological records for 1919 (*New York State Sta. Rpt. 1919, [pt. 1], pp. 533–545*).—Tables are given showing tridaily readings at Geneva, N. Y., of standard air thermometers for each month of the year; daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year; a monthly summary of maximum, minimum, and standard thermometer readings for the year; monthly and yearly maximum and minimum temperatures from 1883 to 1919, inclusive; average monthly and yearly temperatures since 1883; and rainfall by months since 1882.

Ohio weather for the year 1919, W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul. 345 (1920), pp. 479–570, figs. 62*).—Tables showing temperature and

rainfall for the entire State in comparison with similar data recorded at the experiment station at Wooster are supplemented by a series of diagrammatic maps showing the comparative weather conditions for the various sections of the State.

The mean temperature for the year at the station was 51.2° F.; for the State 52.3°. The highest temperature at the station was 95°, July 3; for the State 106°, July 20. The lowest temperature at the station was —4°, December 20; for the State, —12°, December 20. The annual rainfall at the station was 43.08 in.; for the State, 40.33. The number of rainy days at the station was 132; for the State, 117. The prevailing direction of the wind was southwest at the station and northwest in the State at large.

"The year was characterized by a large amount of fine, open weather with abundant sunshine, moderate temperatures, and well-distributed precipitation, and was unusually free from extreme or hurtful conditions, the weather as a rule being highly favorable to the growth of crops and to farm work except toward the end of the year, when field work was interrupted more or less by the continuous rains. Practically the only abnormal conditions worthy of mention were the light snowfall in January and the excessive rainfall in October. In fact, it was the wettest October in the past 65 years and was among the warmest as well."

The rainfall of 1920 (*Met. Mag.* [*London*], *55* (*1921*), *No. 660, pp. 277, 278*).—This is a preliminary survey of rainfall of the British Isles during the year.

SOILS—FERTILIZERS.

The chemistry of crop production, T. B. Wood (*London: Univ. Tutorial Press, Ltd., 1920, pp. [3]+193, figs. 11*).—Those scientific principles of crop production relating to the soil and soil fertility are briefly set forth in this book. The author assumes a knowledge of elementary chemistry and of physical and chemical manipulation on the part of the reader. The subjects covered are the factors of productivity of the soil; sampling the soil, mechanical analysis, and soil types; the water supply of crops and cultivation; the supply of water to crops, weather; various soil constituents; chemical examination of crops and soil; testing the soil, nitrogen; testing the soil, phosphoric acid and potash, retention of manures in the soil; testing the soil, lime; nitrogenous manures; phosphoric acid manures; potash manures, lime, chalk, and marl; farmyard manure; nitrogen fixation and green manuring; the general principles of manuring; and the produce of the land.

The Missouri Soil Survey, H. H. Krusekopf (*Missouri Sta. Circ. 104* (*1921*), *pp. 20, figs. 20*).—A brief description is given of the work of the Missouri Soil Survey, which is operating in cooperation with the Bureau of Soils of the U. S. Department of Agriculture. It is stated that through this cooperative arrangement 45 counties, representing a total of 28,688 square miles, or 41.7 per cent of the State, have been surveyed and mapped. During this work 591 complete soil samples, consisting of 1,513 individual samples from 69 counties, have been secured. These indicate the diversity of the soils of the State, more than 174 distinct and separate soil types belonging to 70 series having been established and mapped. The laboratory studies made incidental to the soil surveys have shown that Missouri soils are deficient in organic matter and nitrogen and more or less deficient in phosphorus. Most of the light-colored prairie soils and the timbered ridge lands have a lime requirement of from 1 to 4 tons per acre.

Soil survey of Louisa County, Iowa, L. V. Davis and J. A. Elwell (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 50, fig. 1, map 1*).—This

survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 253,440 acres in southeastern Iowa. The county consists of two areas of upland and two of lowland. The drift plain uplands have ample surface drainage while the first bottoms are usually subject to overflow, requiring levees and ditch systems. Approximately 60 per cent of the county is upland, 20 per cent terrace, and 20 per cent first bottom. The soils of the county are of loessial, glacial, and alluvial origin. Including river wash and muck, 28 soil types of 13 series are mapped, of which the Clinton, Tama, and Grundy silt loams cover 17, 10.5, and 10.4 per cent of the area, respectively.

Soil survey of the Aroostook area, Me., L. A. HURST ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 44, pls. 4, fig. 1, maps 2*).—This survey, made by the Bureaus of Soils and Plant Industry in cooperation, deals with the soils of an area of 697,600 acres in northern Maine covering the extreme eastern part of Aroostook County. The topography is undulating to hilly with a few low mountains, and the surface is characterized by high, level to undulating ridges, with long sweeping slopes. The area for the most part is naturally well drained. Practically all of the soils of the area are derived either directly or indirectly from glacial materials. Including muck, 15 soil types of 8 series are mapped, of which the Caribou loam, muck, and Washburn loam cover 55.9, 16.2, and 10 per cent of the area, respectively.

Soil survey of Knox County, Mo., H. H. KRUSEKOPF and H. I. COHN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 32, pl. 1, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 328,960 acres in northeastern Missouri lying entirely within the northeast Level Prairie. The topography varies from level prairie to rolling timberland. The stream bottom soils are subject to overflow. The soils of the area are grouped as prairie, glacial, residual, and alluvial, the parent materials being mainly loess and glacial drift. Eighteen soil types of 12 series are mapped, of which the Shelby loam, the Grundy silt loam, and the Putnam silt loam covers 23.5, 21.2, and 16 per cent of the area, respectively.

Soil survey of the Fort Laramie area, Wyo.-Nebr., J. O. VEATCH and R. W. MCCLURE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 50, fig. 1, map 1*).—This survey deals with the soils of an area of 362,240 acres situated in the Great Plains Region of eastern Wyoming and western Nebraska, including the central part of Goshen County, Wyo. Most of the area is included in a great lowland erosion plain. The principal topographic features include (1) the north Platte Valley, (2) the Goshen Hole lowland plain, (3) the Goshen Hole escarpment, and (4) the High Plains proper. There is little naturally wet or poorly drained land with the exception of a few small, low, flat areas. The soils of the area owe their most prominent characteristics to climate. A grayish color predominates, and the subsurface is much lighter in color than the top soil. There is a high relative percentage of soluble mineral salts, a concentration of lime and other salts at shallow depths, a friable and granular structure at certain depths, and a low humus content. Including rough broken land and dune sand, 25 soil types of 11 series are mapped, of which the Rosebud silt loam and very fine sandy loam cover 19.2 and 13.4 per cent of the area, respectively.

The agriculture and soils of the Cape Province, A. STEAD (*Union So. Africa, Dept. Agr. Jour., 1 (1920), Nos. 2, pp. 152–158; 4, pp. 351–358; 5, pp. 429–441; 7, pp. 660–670; 9, pp. 819–828, figs. 12*).—This is a preliminary report on the origin and geology, physical, mechanical, and chemical properties, fertilizer requirements and crop adaptation of the soils of the so-called Witkop-Burgher-sdorp area in the Union of South Africa.

The principal classes of soils recognized are the so-called black turf, which is a heavy clay loam rich in organic matter and found in the valley bottoms;

the sand-bult, which is a sedentary, fine sandy soil retentive of moisture but infertile; and the mixed turf, which is a colluvial soil fairly rich in organic matter and lies at the lower slopes of rather steep hills. With reference to the influence of geological origin on the fertility of soils, it is shown that the best soils of the area are those in which the formation has been influenced by lava or dolerite.

The methods of sampling and analysis used are briefly described in an appendix.

The "alkali" content of soils as related to crop growth, F. T. SHUTT and E. A. SMITH (*Roy. Soc. Canada Proc. and Trans., 3. ser., 13 (1919), Sect. III, pp. 233–242, figs. 4*).—A progress report is given on the second year of studies previously described (E. S. R., 40, p. 719). Two series of studies of wheat soils and one each of western rye grass and oats soils were conducted.

The alkali in an irrigated brown loam soil of good quality growing wheat was mainly sodium sulphate. Where the growth of wheat was good the concentration of sodium sulphate was low and practically uniform. Where the growth was poor the concentration was higher, and where there was no growth the concentration of sodium sulphate was 0.9 per cent and of magnesium sulphate 0.273 per cent. The sulphates of sodium, magnesium, and calcium were found in a second wheat soil which was not irrigated but obtained moisture from seepage from a canal. Where the growth was good the concentration of sodium sulphate was 0.103 per cent in the surface 6 in. and increased with the depth. A poor growth resulted on soil containing 0.5 per cent of sodium sulphate at a depth of 3 ft.

In irrigated sandy loam soil growing rye grass sodium carbonate predominated. Where the growth was good the concentration of sodium carbonate was 0.168 in the top 6 in. of soil, but where the growth was poor the concentration was 0.227 per cent. There was no growth when the concentration reached 0.272 per cent. These results are taken to indicate that the limiting concentrations of sodium carbonate are from 0.1 to 0.15 per cent for rye grass.

Sodium carbonate was also the harmful salt in irrigated brown loam soil growing oats. There was a good growth with a concentration of this salt of 0.066 per cent, and it is concluded that approximately 0.05 per cent in the top 6 in. of soil does not markedly affect the growth of oats. Where the growth was poor the concentration of sodium carbonate was 0.243 per cent in the surface, and there was no growth where the concentration reached 0.477 per cent. The experiments are being continued.

Relation of the calcium content of some Kansas soils to the soil reaction as determined by the electrometric titration, C. O. SWANSON, W. L. LATSHAW, and E. L. TAGUE (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 855–868*).—Experiments conducted at the Kansas Experiment Station, in which a number of soils from different parts of the State were analyzed for total calcium and calcium in forms soluble in N/5 hydrochloric acid and in normal hydrochloric acid are reported. The amount of carbon dioxid in these soils was also determined.

Ten-gram samples of these soils were placed in neutral distilled water, and the initial reaction was determined by means of the hydrogen electrode. Fifth-normal calcium hydroxid was added to change the reaction to a higher alkalinity. The points determined were the number of cubic centimeters of N/25 calcium hydroxid needed to bring the reaction (if lower) to P_H7, $P_H8.3$, and P_H10.

In soils of a high calcium content a larger percentage of the calcium was in forms soluble in these dilute hydrochloric acid solutions than in soils of a low calcium content. As a rule, soils of a high calcium content had a higher initial

hydroxyl-ion concentration than soils of low calcium content. The amount of N/25 calcium hydroxid required to change a soil from a lower to a higher hydroxyl-ion concentration depended more upon the amount of colloidial clay present than upon the calcium content.

Subsoils as a rule were found to have a higher calcium content than surface soils. It required more calcium hydroxid to change these subsoils from a lower to a higher hydroxyl-ion concentration than it did for the corresponding surface soils. This was true for most of the soils. The exceptions were due either to a very high calcium content in the subsoil as compared with the surface soil, to a larger amount of sand in the subsoil, or to some unusual condition of the soil and subsoil. The amount of N/25 calcium hydroxid required to change the acid soils to a reaction represented by P_H7, calculated in equivalent pounds of calcium carbonate per acre, compared favorably with some other current methods of determining the lime requirements of the soil. In some soils the amount of calcium hydroxid, calculated in equivalents of pounds of calcium carbonate per acre, required to change to a concentration represented by $P_H8.3$ was as great as the equivalent amount of acid-soluble calcium present in the soil or greater.

Soil acidity investigations (*Indiana Sta. Rpt. 1920, p. 38*).—Water culture studies on the effect of different hydrogen-ion concentrations of several acids and their aluminum salts showed that both the hydrogen and aluminum ions were toxic in varying degrees to different plants. In the case of such plants as corn and barley the toxicity of soil acidity seemed to be due more to the aluminum than the hydrogen ion.

The results of greenhouse and field plat experiments on acid peaty sand soil pointed to the same conclusion. Another phase of the experiments indicates that available phosphates aid greatly in reducing aluminum toxicity both with and without lime.

Nitrification in acid soils, R. E. Stephenson (*Iowa Sta. Research Bul. 58 (1920), pp. 331–349*).—Pot studies in the greenhouse with Carrington loam soil to which lime was added at rates of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, and 20 tons per acre and in which optimum moisture conditions were maintained are reported. The pots were sampled at intervals of 2, 2, 4, 4, 4, and 7 weeks and tests made of their nitrifying powers. Alfalfa was grown in a second series of pots receiving the same treatments except that the 6, 8, 10, and 15 ton lime applications were omitted.

It was found that nitrification occurred in the presence of a rather high lime requirement. A scarcely measurable effect was produced in the nitrification of the original soil nitrogen by the application of calcium carbonate. Lime did cause a marked increase, however, in the nitrification of ammonium sulphate.

The acid soils were never completely neutralized even with the very heavy application of lime, apparently because of the slow solubility of a part of the acidity present. The results indicate that though very large amounts of lime may give greater nitrification, only that which is necessary to neutralize the most active acids is essential for adequate nitrification.

The growth of alfalfa was at a maximum when an amount of lime approximately equivalent to the indicated requirement was added. Growth was nearly as good without any lime as with the heavier applications.

The fixation of nitrogen in Colorado soils, W. P. Headden (*Colorado Sta. Bul. 258 (1921), pp. 3–48, fig. 1*).—Continuing work previously noted (E. S. R., 25, p. 814), studies of the source, quantities, and relation between the occurrence of nitrates in the soils and well waters of a new district about 14 miles northeast of Fort Collins, Colo., are reported. The study led to the

recognition of a rather large area south and east of Wellington, in Larimer County, throughout which nitrates occur abundantly in the surface soil. Another smaller occurrence in the Dry Creek section south and west of Waverly was also established.

It was found that the waters of shallow wells and the surface soils are closely related in regard to their nitric nitrogen content. No abnormally large amount of nitric nitrogen was found in the soil or in shallow wells of the district outside of the niter areas. The waters from deep wells, even when sunk through or adjacent to areas very rich in nitric nitrogen, were free from it. The composition of the salts held in solution in the deep well waters differed from that of those held in the ground waters. The former held essentially sodium and calcium sulphates, while the latter held magnesium and sodium nitrates and sulphates with some calcium sulphate.

The extracts of soil samples taken from these areas were characterized by the presence of much magnesia and nitric acid and low contents of sulphuric acid, calcium, and sodium. The potash contents of such extracts were uniformly high, varying from 0.7 to 2 per cent of the total soluble portion.

It is considered evident that the ground waters derive their nitrates from the soil, and that the amount is determined by local conditions. It was also found that calcium and magnesium chlorids occur in considerable abundance in some of the soil extracts, and that the surface soil, especially at the edges of these niter areas, has a very high nitrogen-fixing capacity. The view is again expressed that within this area the nitrates are formed in situ through bacteriological agencies.

[Phosphorus combinations and soil potassium] (*Ohio Sta. Bul. 346 (1920), pp. XXII, XXIII*).—Studies on the influence of soil reaction and cultivation upon the organic phosphorus content of soil led to the conclusion that the reaction of the soil is practically without influence upon the proportion of the total phosphorus which is present in organic form. The organic phosphorus compounds of a number of soils, both acid and basic, cultivated and virgin, were apparently quite similar in nature, although there were large variations in the actual amounts present in various soils. The results showed that cultivation and cropping appreciably decrease the total and the organic phosphorus, and in practically the same ratio. It was found that an average of one-third of the total phosphorus of surface soils and one-fifth of that of subsoils is in organic combination. The amounts of organic phosphorus seemed to be closely related to the total organic matter and nitrogen content of the soils studied. The organic phosphorus did not appear to be of a high order of availability.

Studies with oats on the influence of fertilizers on the availability of rock phosphate showed that the phosphorus content of the oat plant, where rock phosphate was applied, was considerably in excess of that of the crop grown on soil not treated with rock phosphate. The most decided indication was obtained from the oats sampled eight weeks after seeding. The percentage of phosphorus at this time was more than twice that of the mature crop. The yield of the oat crop studied was increased by rock phosphate. While the addition of other fertilizers produced a further increased yield with a larger removal of phosphorus, no very definite indications that the fertilizer treatment on individual plats affected the availability of the rock phosphate were obtained.

Studies on the potassium supply of the soil showed that the effect of treatment with fertilizers and lime on the soluble potassium content is apparently due to the larger removal of potassium by crops where conditions are more favorable to crop growth, rather than to the direct action of the additions on the potassium-bearing minerals of the soil.

[Experiments on maintenance of soil fertility] (*Ohio Sta. Bul. 344 (1920), pp. 239–256, 276–287, 302–314, 332–340, 367–372, 374–384, 396–402, 419–441, 454–456, 468, 469, figs. 5*).—Data on the results of experiments at the nine county experiment farms are reported.

For the Miami County Experiment Farm R. R. Barker reports that in six rotations carried through a period of 10 years acid phosphate used at the rate of 200 lbs. per acre for each crop has added 8 bu. to the yield of corn, and the same quantity of acid phosphate reinforced with 50 lbs. of potassium chlorid has added nearly 13 bu. The same amount of acid phosphate has increased the yield of wheat from 11 to 22 bu. where the wheat has followed oats or corn, and from 11 to 27 bu. where the wheat has followed soy beans.

The results of four rotations being conducted on the Paulding County Experiment farm, reported and discussed by H. R. Hoyt, are too irregular to justify any but general conclusions, but are taken to indicate that the soil of the farm is not more deficient in one of the principal elements of fertility than in another, and that profitable increases are to be obtained only through an increase of all three of the main fertility ingredients. The slow-acting phosphates such as raw rock and bone meal seem to have given better results than acid phosphate. Lime appears to have been detrimental. "Taken as a whole, the experiment would seem to encourage the use on sugar beets of a complete fertilizer of much higher grade than any ready-mixed fertilizer ordinarily found on the market."

The results of four experiments with fertilizers, lime, and manure on crops grown in rotation on the Clermont County Experiment Farm, reported and discussed by H. W. Rogers, show that drainage, lime, phosphorus, potassium, and nitrogen are necessary on the impoverished soil of this farm. It was found that when all these ameliorants were employed, using manure as the carrier of nitrogen and phosphorus, the cost of the lime and phosphorus and nearly half that of the drainage was recovered in a single 4-year period.

Data on the results from two rotations in progress on the Hamilton County Experiment Farm, reported by Rogers, are taken to indicate that a much larger use of phosphorus and potassium is justified on Hamilton County crops and that manure and clover should be depended upon as the chief sources of nitrogen.

Soil-fertility studies, by C. E. Thorne, with field crops on the Washington County Experiment Farm, indicate the importance of careful saving and moderate use of manure, supplemented by acid phosphate and powdered limestone on land that can not be reached with the manure. Data on the use of fertilizers and manure on truck crops are reported by Thorne, no conclusions being drawn.

Data on the use of fertilizers and soil amendments on a 4-year rotation of corn, oats, wheat, and clover being conducted on the Trumbull County Experiment Farm, and on the use of fertilizers and manure on three crop rotations and on truck crops on the Mahoning County Experiment Farm, are reported and discussed by J. P. Markley, no conclusions being drawn.

Data on the use of fertilizers in a 5-year rotation at the Belmont County Experiment Farm, reported by C. W. Montgomery, are taken to indicate that phosphorus and lime are the most important constituents of a fertilizer for this soil.

The progress results of two experiments with fertilizers and manure on a 4-year rotation on the Madison County Experiment Farm are reported and discussed by Thorne, no conclusions being drawn.

Comparison of peanut meal, cottonseed meal, velvet bean meal, ammonium sulphate, and nitrate of soda as fertilizers for corn and cotton, E. F. Cauthen (*Alabama Col. Sta. Bul. 215 (1921), pp. 3–8*).—This is substan-

tially a reprint of the results reported in Bulletin 208 of the station (E. S. R., 43, p. 135), to which has been added the result of the 1920 test on cotton. These results give average efficiencies for both crops of 80 for cottonseed meal, 87 for peanut meal, and 54 for velvet bean meal, as compared with sodium nitrate.

Manufacture of synthetic ammonia at Oppau, Germany, I–III (*Tech. Moderne, 1920, Nov., pp. 449–460; also in Chem. and Metall. Engin., 24 (1921), Nos. 7, pp. 305–308; 8, pp. 347–350; 9, pp. 391–394, figs. 22*).—The processes and apparatus used at this plant in the manufacture of synthetic ammonia and other nitrogenous compounds for use as fertilizers are described.

In this process water gas is mixed with producer gas in convenient proportions, steam is added to the mixture, and the whole is passed over a catalyzer at a temperature between 400 and 500° C. The carbon monoxid and steam react, producing hydrogen and carbon dioxid. The carbon dioxid is dissolved in water under pressure and the remaining gaseous mixture is freed from harmful traces of carbon dioxid and carbon monoxid by passing it through solutions of caustic soda and ammoniacal copper formate.

The resulting gaseous mixture contains about 3 volumes of hydrogen per volume of nitrogen. It is subjected under pressure of 200 kg. and at a temperature of about 500° to the action of a second catalyzer, producing a little ammonia, which is immediately absorbed by water. Fresh amounts of gases are added to the remaining gases, which do not combine during this operation, and the whole is passed again through the catalyzer.

The ammonia obtained by the distillation of the solution may then be oxidized by catalysis, combined with nitric acid thus formed to give ammonium nitrate, used for the production of ammonium chlorid by the Solvay process or used for the production of ammonium sulphate by reaction with gypsum in the presence of carbon dioxid.

At this plant different fertilizers are manufactured, such as ammonium nitrate, ammonium potassium nitrate, and a mixture of ammonium nitrate and potassium chlorid.

I, Potash shales of Illinois. II, Geology, distribution, and occurrence in Union County. III, Finely ground shale as a source of potassium for soil improvement, S. W. Parr, M. M. Austin, F. Krey, and R. Stewart (*Illinois Sta. Bul. 232 (1921), pp. 225–252, figs. 7*).—This bulletin consists of three parts and was prepared jointly by the University of Illinois, the Illinois Geological Survey, and the Illinois Experiment Station.

Part 1 presents a brief account of studies of the potash-bearing qualities of certain Illinois oil shales. It was found that shales occur in at least two localities in the State which contain 5 per cent or more of potash. It is noted that shale outcropping near Jonesboro, in Union County, which contains 5 per cent of potash, would be suitable for use in the manufacture of Portland cement. By applying the known methods of potash recovery in cement manufacture, it is estimated that a yield of 5.3 lbs. of potash, valued at from 70 to 80 cts. per barrel of cement, could be obtained. The southern Illinois shale contains free oil, bituminous matter, pyrite, undecomposed potassium-bearing feldspathic rock, and potassium-bearing material of the nature of glauconite. Shale from Dixon, Lee Co., contains 5.8 per cent of potash, which is held for the most part in a more stable condition than that in the southern Illinois shale. Extraction of the potassium from shale of either the southern Illinois or the Dixon type by means of solid or liquid reagents would seem to be impracticable because of the cost of leaching and recovering potash from material where it is present in such small amounts. The plant availability of the potash in the southern Illinois shale is probably characteristic of all the

material of this type outcropping in that locality. That part of the potassium in the southern Illinois shale which is soluble in sulphuric acid is shown to be in a combination of the glauconite type. In southern Illinois shale having a potash content of 5 per cent in the raw condition or 5.6 per cent when ignited, 62 per cent of the total potash is glauconitic in character and is available as plant food.

Part 2 gives data on the geology, location, occurrence, and distribution of the potash-bearing shales of Union County.

Part 3 reports preliminary studies on the availability of finely ground shale as a source of potassium for soil improvement. These included a series of greenhouse pot cultures with wheat, oats, clover, corn, rape, and buckwheat, using peaty soil treated with finely ground leucite, kainit, alunite, and ignited alunite. It was found that the potassium in the shale can be used directly by crops in pot cultures under greenhouse conditions, and the results are considered to warrant more extended investigations, particularly in the field.

American potash equal to German potash salts as fertilizer (*Indiana Sta. Rpt. 1920, p. 36*).—It has been found that most American potash salts are equally as good for fertilizer as German potash salts. A borax test showed that even small amounts of borax in fertilizers drilled in the row with corn injured the crop. On the other hand, 16 lbs. of anhydrous borax per acre in broadcast fertilizer did no appreciable harm.

The American potash industry and its problems, J. E. Teeple (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 249–252*).—A description of the problems encountered in the production of Searles Lake potash is given, together with the methods arrived at in their solution.

Bat guano and its fertilizing value, W. A. Albrecht (*Missouri Sta. Bul. 180 (1921), pp. 15, figs. 7*).—A brief study of bat guano and tests of its fertilizing value are reported, special attention being paid to guano from caves in Missouri.

Analysis of guano from Missouri caves showed that the nitrogen content varies from 0.31 to 10.44 per cent, phosphoric acid from 2.5 to 7.9 per cent, and the potash from 0.36 to 1.9 per cent. Its moisture content is usually high, often approaching 50 per cent.

Ammonification tests showed that the fresher bat guano produced ammonia in amounts equal to that of tankage. Even greater amounts of nitrates were produced. Guano was not the equal of dried blood in ammonia and nitrate production.

Pot culture experiments with oats showed that bat guano gave results superior to those given by dried blood, tankage, and ammonium sulphate. Guano also gave better results than ammonium sulphate in field experiments with oats. Brief recommendations for the use of guano are given.

The influence of marine fertilizers on the shores of the Gulf of Morbihan, A. Choveaux (*Ann. Géogr., 29 (1920), No. 162, pp. 417–425, fig. 1*).—A brief description is given of the use of natural fertilizers of marine origin, including marls, marine algae, and organic and mineral mixtures, by the inhabitants of the islands in the Gulf of Morbihan in western France.

Fertilizer production and natural fertilizers in the Union, C. F. Juritz (*So. African Jour. Indus., 3 (1920), Nos. 6, pp. 495–509; 7, pp. 618–626*).—The results of a survey and investigation of some of the waste and raw materials in the Union of South Africa, capable of conversion into fertilizers, are reported.

The materials investigated included abbatoir offal, refuse from fisheries, tanneries, military camps, and hospitals, mining compounds, bones, and rock phosphates, various plant products, and sugar-factory waste. In conclusion, it is stated that of all the sources of fertilizers in the Union, none is funda-

mentally more important than those which can supply soil and plant with phosphatic material. It is pointed out, however, that phosphate rock can not benefit the growing crop to any appreciable extent until several years after application.

One of the chief potential sources of potash in South Africa is said to be the wool industry. Potash in the carbonate form is present in Karroo ash and in plant ashes generally, but can not be safely used on soils having a tendency to become alkaline.

Inspection of commercial fertilizers for 1920, H. R. KRAYBILL, T. O. SMITH, and C. P. SPAETH (*New Hampshire Sta. Bul. 196 (1920), pp. 15*).—This bulletin contains the results of actual and guarantied analyses of samples of 100 brands of fertilizers and fertilizer materials collected for inspection in New Hampshire during 1920. Of the samples analyzed, 22 per cent showed a deficiency of 0.2 per cent or more in one or more of the main plant nutrients.

AGRICULTURAL BOTANY.

Sturtevant's notes on edible plants, edited by U. P. HEDRICK (*New York State Sta. Rpt. 1919, pt. 2, pp. VII+686, pl. 1*).—Descriptive notes are given of nearly 3,000 species of edible plants in which their original habitats, geographical distribution, variation under cultivation, and uses are indicated. The arrangement is alphabetical by genera and species, and for many, common English and vernacular names are given. The book is based on voluminous manuscripts and notes that have been in possession of the station since 1887, when Dr. Sturtevant ceased to be director.

The North American species of Pennisetum, A. CHASE (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 22 (1921), pt. 4, pp. X+209–234, figs. 14*).—A revision is given of 14 species of Pennisetum which occur in North America, only one of which is indigenous in the southern United States.

The progress of mendelism, W. BATESON (*Nature [London], 104 (1919), No. 2610, pp. 214–216*).—In a review of recent research and discussion, it is pointed out that much of the new work on genetics is in the incipient stage and that much wider tests than those yet made are needed. Among the objects of attack the most important is the question at what point of time segregation occurs. In examples cited, segregation is supposed not to antedate the constitution of the sexual organs. Particulars cited emphasize the suggestion that, considered as genetic mechanisms, plants may be fundamentally distinct from animals, which suggestion is already presented by the contrast between their modes of growth.

Though sex behaves in so many ways as a Mendelian allelomorph, showing frequent phenomena of linkage, it is considered remarkable that no case of crossing over in respect of these linkages has yet been established. Many complex cases of interaction between factors have been successfully analyzed. The balance of evidence perhaps suggests that many factors can, and on occasion do, break up (as a sex factor almost certainly does), some commonly, others exceptionally, while others, again, seem to maintain their individuality unimpaired indefinitely. As bearing on evolutionary theory, the new work leaves us still without any uncontrovertible example of coderivatives from a single ancestral origin producing sterile offspring when intercrossed.

The present position of the mutation theory, H. DE VRIES (*Nature [London], 104 (1919), No. 2610, pp. 213, 214*).—This is a synthetic review dealing with views and tendencies with regard to the appearance, propagation, and establishment of new characters in both animals and plants.

Since the publication of the author's book on the mutation theory, numerous instances of mutation have been observed in both animals and plants. It is now generally conceded by mutationists that the initial change takes place in the production of the sexual cells before fecundation. From this conception it follows that the chance of two similarly mutated cells to meet one another in this process must be very small, whereas ordinarily the mutated cells will combine with normal ones. This must produce half mutants, and these may, in ordinary cases at least, split off the full mutants after the same rules which Mendel discovered for his hybrids. Sometimes the half mutants will be distinct from their ancestors, as in *Œnothera lamarckiana rubrinervis* and *erythrina*, and, therefore, will easily be discovered. In other instances external differences may be absent, and only the unexpected production of a new type in about 20 to 25 per cent or more of the individuals will betray the internal change. This explains the mass mutations discovered by Bartlett. Such an indirect way of producing mutations by means of two successive steps seems to be very common in nature, and will probably afterwards prove to be the general rule. The broad arguments for the mutation theory are continually increasing in number, whereas the criticisms are more and more directed against special cases. They are concerned with the possibility of experimental proof and with the fitness of the material for further studies, but are not expected to invalidate the theory as such.

Plant distribution around salt marshes in relation to soil acidity, E. T. Wherry (*Ecology, 1 (1920), No. 1, pp. 42–48*).—As a result of determinations of soil acidity and alkalinity made upon plants growing under the widest possible range of physical and climatic conditions, the author has found abundant evidence that the acidity of the soil is closely connected with the distribution of native plants. An account of a few observations is presented here to illustrate the possibilities of this method in throwing light on the significance of peculiar types of plant distribution. The measurement of the actual soil acidities and alkalinities connected with certain species of plants, which is all that is attempted here, is deemed but one step in the working out of the problem of why a given plant grows in a certain place, but the results presented are intended to show the considerable, if not fundamental, importance of this often neglected step.

Floral and extrafloral nectaries, H. Böhmker (*Bot. Centbl., Beihefte, 33 (1917), 1. Abt., No. 2–3, pp. 169–247*).—This is a detailed account of nectaries in a large number of monocotyledons and dicotyledons, with bibliography and summation of facts regarding anatomy and physiology and products or contents of nectaries.

Vivipary in grasses, W. Kinzel (*Ztschr. Pflanzenkrank., 26 (1916), No. 5, pp. 285–291*).—This is an account with brief discussion of work left unfinished in 1915 on viviparousness in grasses and its relation to other disturbances of normal seed development.

Seasonal changes in the chemical composition of apple spurs, H. D. Hooker, jr. (*Missouri Sta. Research Bul. 40 (1920), pp. 3–51, figs. 28*).—The author reports on investigations of apple spurs, with leaves, flowers, or fruit removed, collected at six different times during the year, their chemical composition being studied in relation to their physiological condition. Three types of spurs were investigated, those that blossomed and bore fruit; spurs that did not blossom, but which developed fruit buds; and barren spurs that neither blossomed nor developed fruit buds. Determinations were made of the dry weight, ash, titratable acidity, potassium, phosphorus, total nitrogen,

reducing and nonreducing sugars, starch, total polysaccharids, and hydrogen-ion concentration.

It was found that the seasonal changes in most of the constituents examined were distinct and characteristic of the condition of the spur as to its bearing, nonbearing, or barren quality. In general, the bearing and sterile spurs showed extreme values, while the nonbearing spurs assumed an intermediate position.

The conditions characteristic of the bearing and nonbearing spurs of the same tree were found to be practically identical with the conditions of spurs from different trees in bearing and in the off year, respectively. Spurs from barren trees were characteristically distinct from the two types of spurs from productive trees. For most constituents the spurs were found to pass through one period of maximum content and one of minimum content during the course of the year. In the case of starch and titratable acidity there were found two maxima and two minima, the maxima of one coming at practically the same time as the minima of the other. Carbohydrate consumption and acidity were found to be correlated.

Conditions leading to high starch and low nitrogen content at the time of fruit-bud differentiation were found essential for productivity. Fruit-bearing spurs that developed leaf buds had a low starch and a high nitrogen content, and barren spurs a low starch and low nitrogen content. The starch-nitrogen ratio is considered more indicative than the total carbohydrate ratio.

There was found during the late summer and fall a steady increase in the phosphorus and nitrogen content of spurs with fruit buds. The absence of this feature in barren spurs is said to suggest a necessity for phosphorus and nitrogen storage, making possible the marked increase in these elements that is peculiar to bearing spurs in the spring.

Growth and sap concentration, H. S. Reed (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 81–98, figs. 7*).—In a contribution from the Citrus Experiment Station, Riverside, Calif., the author gives an account of investigations on the comparative concentration of sap as related to the growth rate of young walnut, apricot, and orange trees. The growth and sap concentration of young trees was found to vary in opposite directions; that is, rapid growth was associated with a generally lower concentration of sap in the shoot, while slower growth was accompanied by higher concentration of sap. There was found to be a gradual increase in sap concentration as the season advanced. In apricot trees the concentration continued to increase for some time after active growth had ceased.

Of several environmental factors measured, soil moisture was the only one found to have an obvious effect upon sap concentration. The addition of water to the soil usually diminished the concentration of the plant sap. The sap concentration of shoots on heavily pruned trees was lower than that of shoots on trees not pruned, because of the more rapid growth of the former.

A greater concentration of sap was found in the apical portion of the stems than in the basal regions, and the concentration of sap in stems showed a greater tendency to fluctuate than that in the leaves. Generally, lower concentrations of sap in the shoot appeared to be associated with abundant water intake and rapid vegetative growth. Higher concentrations were associated with slow growth and fruit-bud formation.

The results of this investigation are said to indicate that the practice of summer pruning fruit trees is not only unnecessary but may be detrimental.

The magnitudes and variations of osmotic values, G. Blum (*Bot. Centbl., Beihefte, 33 (1917), 1. Abt., No. 2–3, pp. 339–445*).—Extensive data are detailed with discussion as obtained from a study of osmotic behavior in *Helleborus foetidus, Urtica dioica, Fagus silvatica, Sedum acre,* and *Funaria hygrometrica.*

Comparative utilization of the mineral constituents in the cotyledons of bean seedlings grown in soil and in distilled water, G. D. BUCKNER (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 875–880*).—In a contribution from the Kentucky Experiment Station the author describes an experiment undertaken with a view to comparing the degree of utilization of the total ash and the elements calcium, magnesium, and phosphorus in the cotyledons of bean seedlings grown in distilled water and in garden soil. This investigation was in continuation of work previously noted (E. S. R., 34, p. 427). It was found that when beans were grown in soil a notably larger amount of reserve material was translocated from the cotyledons than when they were grown in distilled water. In both cases a smaller proportion of calcium was translocated than of phosphorus or magnesium.

Heat production by germinating seed, E. LEICK (*Bot. Centbl., Beihefte, 33 (1917), 1. Abt., No. 2–3, pp. 309–338*).—Data are given in tabular form regarding the heat developed during the germination of different seeds.

A study of the photosynthesis of sugar cane, G. G. YAP (*Philippine Agr., 8 (1920), No. 8–9, pp. 269–276*).—This work deals principally with the amount of carbon dioxid which the leaf absorbs from the air during photosynthesis. The method employed is that involving the measurement of the amount of carbon dioxid absorbed by the leaf. The results of the studies are tabulated with discussion.

It was found that the rate of photosynthesis decreases from 10 a. m. to 4 p. m., with maximum activity from 8 to 10 a. m. Very young leaves were found to be most active, the activity decreasing with age. The rate of respiration appeared to be less than one-half that of photosynthesis. High light intensity probably had an indirect relation to the rate of photosynthesis, tending to decrease this activity. The rolling of the tips of the leaves appeared to be associated with the decrease in the rate of photosynthesis.

Carbon monoxid a respiration product of Nereocystis luetkeana, S. C. LANGDON and W. R. GAILEY (*Bot. Gaz., 70 (1920), No. 3, pp. 230–239, figs. 3*).—The work here dealt with at greater length than in a recent note (E. S. R., 44, p. 28) is said to have confirmed the conclusions of Langdon, as previously noted (E. S. R., 26, p. 804), regarding the existence of a percentage of carbon monoxid in the gas contained in the pneumatocyst of the Pacific Coast kelp *N. luetkeana.*

The substance of the kelp when ground and permitted to undergo autolysis and decay does not form carbon monoxid by enzym action or fermentation process, although living plants, in which the gas normally present within the floater is replaced by air, form several per cent of carbon monoxid within a few days. Gas obtained from the cavities of various other plants failed to show a similar occurrence of free carbon monoxid.

Gas injury to plants, P. SORAUER (*Ztschr. Pflanzenkrank., 26 (1916), No. 3–4, pp. 129–183, pl. 1, figs. 5*).—Flowers after opening were checked by contact with illuminating gas and often altered as to coloration. Unopened flowers seldom developed further. Leaves fell or wilted with yellowing and drying from the tip or edge inward, or spotting. More axial portions of the plants showed a considerable variety of changes, some of which are detailed as are those in the roots.

The study here noted leads to the general conclusion that the consequences of poisoning by illuminating gas are symptoms indicating suffocation from lack of oxygen and accumulation of water in the lower axis with deprivation of water in the higher portions.

FIELD CROPS.

[Report of field crops work at Holly Springs, Miss., Substation, 1915–1920], C. T. AMES (*Mississippi Sta. Bul. 193 (1920), pp. 1, 4–21, figs. 2*).—Variety tests of cotton on hill and valley land, corn, and sweet potatoes; cotton spacing experiments; fertilizer trials with cotton, corn, and legumes; and lime tests with corn, oats and vetch, and cowpeas, conducted during the period 1915–1920 are described; and information presented on the culture of Bermuda grass pasture, sweet potatoes, crimson clover, bur clover, velvet beans, and alfalfa. Earlier work with field crops at this station has been noted (E. S. R., 32, p. 526).

The results of cotton variety tests during the period commend Cleveland strains, Wannamaker-Cleveland, Miller, Cleveland Big Boll, and Triumph for hill land, and Wannamaker-Cleveland, strains of Trice and Express, Webber 49, and Sunflower for valley land. The average results of five years' spacing tests indicate that, on land which with the addition of fertilizer will average three-quarters of a bale per acre, cotton should be planted in 3.5-ft. rows and thinned to 10 or 12 in. On less productive land, 3-ft. rows and closer spacing are suggested. From the tabulated results of 13 years' fertilizer tests with cotton, it is concluded that the use of both nitrogen and phosphorus are beneficial, with applications of 200 lbs. of cottonseed meal and 200 lbs. of acid phosphate per acre giving the best results.

Work with corn has been noted from another source (E. S. R., 45, p. 37).

Triumph, Porto Rican Yam, and Nancy Hall, with four-year average acre yields of 294, 281, and 240 bu., respectively, headed the sweet potato varieties.

[Field crops work on county experiment farms in Ohio in 1918 and 1919], C. W. MONTGOMERY ET AL. (*Ohio Sta. Bul. 344 (1920), pp. 237, 238, 256–258, 270, 271, 273, 274, 287–289, 298, 299, 314–317, 327, 328, 341–343, 355–357, 373, 374, 395, 403–406, 441–443, 457, 458, 470, 471, 475, 477, 478, fig. 1*).—The continuation of work with field crops on experiment farms located in Miami, Paulding, Clermont, Hamilton, Washington, Trumbull, Mahoning, Belmont, and Madison Counties is reported along the same general lines as noted heretofore (E. S. R., 39, p. 737). The experiments comprised rotation tests, including corn, oats, wheat, clover, soy beans, sugar beets, potatoes, and tobacco; fertilizer, manuring, and liming tests with the crops in the rotations; fertilizer tests on pasture; variety trials with corn, oats, wheat, and soy beans; date and rate of seeding tests with wheat; and a comparison of drilling soy beans solid and in rows. The data obtained are tabulated and discussed in separate reports for each county. Summarized results of all the fertilizer experiments and variety tests are tabulated. The varieties of the different crops outstanding in the tests have been noted previously.

[Report of field crops work in the Virgin Islands, 1920], L. SMITH (*Virgin Islands Sta. Rpt. 1920, pp. 7–17, 18, 19, pls. 2, fig. 1*).—The continuation of work similar to that noted heretofore (E. S. R., 44, p. 332) is reported for the year 1920.

Work with sugar cane included breeding experiments and trials of seedlings and varieties. The average increases given by the best St. Croix varieties over Ribbon, the standard, were as follows: S. C. 12/37, 8.4 tons of cane and 2,303 lbs. of sucrose; S. C. 12/4, 3.4 tons of cane and 1,197 lbs. of sucrose; and S. C. 14/93, 5.4 tons of cane and 1,365 lbs. of sucrose. Other seedlings outstanding included S. C. 13/13, B. 3412, B. 16536, B. 4596, B. 6388, and B. H. 10/12.

Only 180 acres of cotton were planted on the island of St. Croix in 1920 and the yields averaged only about 600 lbs. of seed cotton per acre. The lint of St. Croix Sea Island cotton brought from $1.80 to $2 per lb. in the Liverpool markets. The largest yield obtained in plat tests was at the rate of 4,450 lbs.

of seed cotton per acre, individual plants giving over 2 lbs. of seed cotton each. The lint length of this variety was 1¼ in.

Corn experiments on ear-to-row improvement and hybridization are briefly noted.

Sweet potatoes manured at the rate of 20 tons per acre produced only one-half the yield of those grown on unmanured plats.

In tests of legumes for various purposes, velvet and Lyon beans were best for green-manuring purposes, Black Venezuelan for seed, and Longfellow Six Weeks and Madagascar for string beans. Notes on Napier grass, Guatemala grass, and castor bean selections are also given.

Pasture plants and pastures of New Zealand, F. W. HILGENDORF (*Auckland and London: Whitcombe & Tombs, Ltd., 1918, pp. 96, figs. 36*).—A practical handbook, designed for farmers and students of New Zealand, comprising descriptions of the botanical and agricultural characters of common pasture grasses, weed grasses, native grasses, clovers, and other pasture plants, with artificial keys for the identification of grasses and cloverlike plants. Pasture management and improvement are treated at some length, and grass mixtures are suggested for various purposes and soil types.

Lodging of small grain (*Ohio Sta. Bul. 346 (1920), pp. XX, XXI*).—Moisture determinations made on the stems of plants grown in the greenhouse indicated that the points just above the nodes are the weak spots. However, determinations of breaking strength made on plants soon after the first appearance of the heads, while the stems and leaves were both green, showed that at that stage of growth the breaking of the stem occurs almost always below the nodes, indicating that even though the weak points in the culms are immediately above the nodes, the support offered by the green leaf sheath is such as to render that part of the stem stronger than the part just below the nodes. As the plants approach maturity and the leaves begin to dry and the sheath begins to loosen its hold around the stem, the stems then almost invariably break above the nodes.

Investigations of spontaneous combustion of hay, G. LAUPPER (*Landw. Jahrb. Schweiz, 34 (1920), No. 1, pp. 1–54, figs. 5; abs. in Jour. Min. Agr. [London], 27 (1921), No. 12, pp. 1163, 1164*).—The author presents an exhaustive account of earlier work and current investigations concerning the firing of haystacks and discusses in detail the chemical reactions involved in spontaneous combustion. From the results of recent researches, the probable causes of firing of haystacks may be stated as follows:

Four successive phases may be distinguished in the heating of haystacks. In the first phase, the hay sweats and generally reaches a temperature of 50° C. (122° F.) within two days. The second phase is characterized by increased sweating, and much vapor, accompanied by an aromatic odor, is given off. The hay turns light brown in color and reaches a temperature of 70° in about a week. In the third stage the temperature rises to 90°, being accompanied by much vapor and a pungent odor, and resulting in a dark brown hay. The duration of this phase may run from two to three weeks. The fourth phase, a very dangerous period, culminates in combustion. The temperature from 90° to ignition may be reached in two hours. The phase consists of a damp distillation followed by dry distillation, gases are exhaled, a pungent and slightly burning odor may be detected, and the hay rapidly carbonizes. Hay reaching this phase without eventually firing has a black-brown or black color, and has lost most of its nutritive value.

The first and second phases are considered desirable in hay making. The heating in the first phase is due to the respiratory activity of the plant cells, while that in the second phase is variously attributed to bacterial action, fer-

ment activity, and the catalytic action of combinations of iron and manganese. Further research appears to be necessary to determine the exact cause of this heating, with the view of preventing the onset of the third and fourth phases. The rise of temperature in these latter phases is the result of causes entirely chemical in origin.

Heating in the stack is most liable to occur with young grasses containing a large proportion of water-soluble material. Likewise in heating, the losses fall on the water-soluble material, that part of the hay of the best feeding value.

Particular points to be derived from the researches are as follows: The better the quality of forage used the more care will be required in curing the hay and building the stack in order to avoid excessive heating. The heating of the stack is dependent on the amount of water-soluble material present as well as on the presence of moisture. Rain-washed hay, even when obtained under unfavorable conditions, rarely overheats in the stack. The chief aim should be to cure the hay at the lowest possible temperature to avoid loss of nutritive value in the resulting product. The temperature of the stack will indicate the possibility of overheating and the need of precautionary measures. The warning point is 70°, and a temperature of 90° marks the critical point and indicates immediate precautionary measures. A temperature of 110° indicates the explosive point; opening of the stack at this stage will probably lead to immediate firing. Where the hay has been obtained in good condition the principal aim in stack building and in the prevention of overheating should be consolidation and not ventilation.

Handbook of legume culture, C. FRUWIRTH (*Handbuch des Hülsenfrüchterbaues. Berlin: Paul Parey, 1921, 3. ed., rev. and enl., pp. VIII+231, figs. 75*).—A revised edition of a work noted previously (E. S. R., 32, p. 432).

Effect of time of irrigation on kernel development of barley, H. V. HARLAN and S. ANTHONY (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 29–45, figs. 20*).—Studies of the effect of time of irrigation on kernel development of barley, made cooperatively at the Aberdeen, Idaho, Substation, by the Office of Cereal Investigations, of the U. S. Department of Agriculture, and the Idaho Experiment Station, are reported, supplementing other work on the kernel development of barley at this substation, noted (E. S. R., 43, p. 826). The average length, lateral and dorsoventral diameters, and percentage and weight per kernel of dry matter, water, nitrogen, and ash in kernels of Hannchen barley sampled at 24-hour intervals from eight plats variously irrigated are included in tabular and graphic form and discussed.

Deposit of dry matter in the kernel continued until very near the point of absolute ripeness. The plants were able to utilize water up to the date of full maturity. Late irrigation resulted in a greater activity and a later maturity. Deficiency of water, even after the spikes were losing their color, resulted in a checking of the deposit of dry matter. "A deficiency of water earlier in the development of the kernel probably determines the size of the kernel, even before the rate of deposit of dry matter is checked."

Corn experiments, H. B. BROWN (*Mississippi Sta. Bul. 197 (1921), pp. 3–20, figs. 3*).—The present bulletin presents data secured in corn experiments at the College Station since 1915 along the same lines as and supplementing work noted previously (E. S. R., 33, p. 34). Cultural practices for the eastern and central parts of the State are recommended, together with notes on corn breeding.

Vardaman, Jones Prolific, Tennessee Red Cob, and Cockes Prolific ranked highest in variety tests during five or more years. Selections of Paymaster, Tennessee Red Cob, and Mosby were outstanding in 1919 and 1920 tests, while

early northern varieties, such as Johnson County White and Champion Early White, produced much damaged and rotten corn and ranked low in yield. The planting of early varieties is discouraged by the station. Large, vigorous-growing varieties, such as Tennessee Red Cob or Cockes Prolific, appeared to do best on infertile hill land. Laguna, Mexican June, Cockes Prolific, and Goliad are recommended for late planting.

Results of eight years' work with about 25 varieties in different combinations of hybrids showed that although the hybrid seed usually produced plants yielding better than those from either parent, the gain did not pay for the extra cost of producing the hybrid seed. Selfed corn exhibited marked reduction in vigor the first generation after selfing, and as a rule yielded less than one-half as much as the original open-pollinated strain. Varieties sustaining inbreeding best were usually those yielding well in other tests.

In tests of nitrogenous fertilizers in 1919, corn receiving cyanamid and ammonium nitrate averaged 38.9 and 44.1 bu. per acre, respectively, as compared with 33.3 bu. from the unfertilized check. In 1920, 100-lb. applications of cyanamid, ammonium nitrate, and nitrate of soda made average gains of 9.3, 14.2, and 10.6 bu. per acre, respectively, over the check, and 200-lb. applications of the same fertilizers made gains of 6.9, 14.4, and 15.2 bu., respectively. Treatment of 20 varieties with 200 lbs. of nitrate of soda returned an average yield of 55.8 bu. per acre, as compared with 45.7 bu. from the untreated plats, a net gain of $2 per acre from the use of the fertilizer being recorded.

Corn variety tests, 1913–1920, [at] Delta [Miss.] Branch Station, W. E. Ayres (*Mississippi Sta. Bul. 198 (1921), pp. 3–7*).—From the results of tests conducted from 1913 to 1920, inclusive, at the Delta Substation, Ewing Mosby, Woodruff Mosby, Cockes Prolific, Hastings Prolific, and Vardaman are considered the best corn varieties for delta conditions. Cockes Prolific led in 1918 and in 1920 tests planted May 28, while Ewing Mosby was first in 1919 and in the 1920 tests planted July 2.

Corn in Missouri.—I, Corn varieties and their improvement, L. J. Stadler and C. A. Helm (*Missouri Sta. Bul. 181 (1921), pp. 3–50, figs. 7*).—Results of variety tests of corn for the period 1905 to 1920, inclusive, are reported, supplementing those recorded in Bulletin 143 (E. S. R., 36, p. 135). Yields of the several varieties for periods of years at the station, outlying fields, and in cooperative tests are tabulated and discussed for the several soil types of the State. Of the various methods of corn improvement, continuous selection of seed corn in the field is recommended as most practicable for the farmer. Germination tests are advised for the detection of disease even when the germinability of the seed is unquestioned.

The best varieties for the several important agricultural sections of the State are listed as follows: Northern upland soils, Reid Yellow Dent and Leaming; central upland soils, Boone County White, St. Charles White, and Commercial White; southern upland, Commercial White; southeast lowlands, St. Charles White; and north and south bottom lands, Boone County White. In tests of corn for silage purposes at Columbia, Commercial White, St. Charles White, St. Charles Yellow, and Cartner were respectively outstanding in order of maturity.

Shrinkage determinations for various periods in the several sections of the State indicate that in northern and central Missouri the shrinkage varies considerably, while in the southern section of the State it is slight in degree and varies but little with the variety.

Cotton growing in south Mississippi, E. B. Ferris (*Mississippi Sta. Bul. 196 (1920), pp. 3–8*).—Information concerning varieties, cultural practices, and fertilizers considered best in the production of cotton in southern Mississippi is

presented, together with tabulated results of variety tests at Poplarville from 1918 to 1920, inclusive, and fertilizer tests at Poplarville and McNeill.

Trice cotton appears to be the best under average conditions. From results of fertilizer tests at both substations, it is held that the use of raw phosphate and soft phosphate rock did not pay. Although basic slag was more available than these two forms, it was behind acid phosphate in this respect, which in moderate amounts with rather small quantities of nitrogen is considered the most desirable treatment.

Cultural experiments with cotton, G. B. WALKER and W. E. AYRES (*Mississippi Sta. Circ. 35 (1921), pp. [4]*).—Results of spacing tests conducted at the Delta Substation are presented with information regarding the culture of cotton under delta conditions. In 1919 and 1920 tests, where cotton was thinned from 8 to 28 in. in the row, 8-in. spacing made the highest yields practicable with an average increase of 471 lbs. of seed cotton worth $54 per acre over 28-in. spacing. The yield decreased consistently with the decrease of stand. In all plats where the plants were more than 8 in. apart, plats with two plants per hill yielded more than those with only one plant. In summarizing the results of spacing work at other stations, it is noted that 12-in. spacing gave the best results in every series of tests.

A table of factors, by which the number of bolls on 30 ft. of row may be multiplied to obtain the number of pounds of lint per acre, has been noted from another source (E. S. R., 44, p. 435).

Report of cotton experiments at the Holly Springs Branch Experiment Station, 1919 and 1920, C. T. AMES (*Mississippi Sta. Bul. 192 (1920), pp. 3–10*).—Results of variety studies on hill and valley land, fertilizer trials, spacing tests, and weather records secured during the years noted are presented, together with suggestions for cotton culture on the brown loam soils. Conclusions based on the foregoing are embraced in the material noted on page 126.

Cotton experiments, 1919 and 1920, H. B. BROWN and C. B. ANDERS (*Mississippi Sta. Bul. 187 (1920), pp. 32, figs. 4*).—The continuation of cotton experiments at the station along the same general lines as noted heretofore (E. S. R., 42, p. 232) is described for the years indicated. Unfavorable weather in the summer of 1919 and the spring of 1920 hindered cotton production, and much boll weevil damage was reported throughout the State during both years. Cultural methods for eastern and central Mississippi and the results of tests of calcium arsenate as a boll weevil poison are outlined briefly. Statistics of the cotton acreage and production in the counties of the State in 1918, 1919, and 1920 are appended.

Cleveland and Miller are recommended for thin hill land; Trice for rich hill land, wilt-free; Express, Trice, and Foster for delta and valley land, wilt-free, but with heavy weevil infestation; Cleveland, Express, and Columbia for valley land with light wilt infection and light weevil infestation; and Tri-Cook and Lewis 63 for heavy wilt infection but few or no weevils.

In preliminary studies of oil content, a variation of more than 12 gal. of oil per ton of seed in 25 strains grown on the same plat was noted. With but few exceptions, the oil content increased as did the length of staple, indicating positive correlation, while it decreased with an increase of lint percentage, an increase of size of seed, and an increase of nitrogen (ammonia) content, indicating negative correlations.

Varieties of cotton 1919 and 1920, and summary of 10 years' results, 1911–1920, [at] Delta Branch Station, W. E. AYRES (*Mississippi Sta. Circ. 36 (1921), pp. [4], fig. 1*).—Data in this publication show Express to lead in 10-year average yields with an acre value of seed and lint of $140.72. Foster and Wannamaker-Cleveland followed closely, and Cleveland Big Boll, Miller,

and Triumph were the poorest producers. Earlier work has been noted previously (E. S. R., 42, p. 232).

In 1919 experiments, selections of Cook, Trice, Foster, and Express were first in lint production. The early varieties ranked high in yields, while early long-staple cottons led in money value. The average value of the seed and lint of the three leading varieties was $298.84 per acre, while that of the three poorest was but $132.35. In 1920, Foster, Cleveland, and Cook selections and Wannamaker-Cleveland were outstanding.

A native legume forage for warm and hot climates (Desmodium leiocarpum), C. D. Girola (*Bol. Min. Agr. [Argentina], 25 (1920), No. 3, pp. 375–387, fig. 1*).—The author describes the plant and its adaptation, indicates cultural methods, and includes comparative analyses and data regarding the feeding value of *D. leiocarpum*. This plant is said to be particularly adapted to warm and hot regions in Argentina where alfalfa and the clovers do not flourish.

Lespedeza (Japan clover), S. H. Essary (*Tennessee Sta. Bul. 123 (1921), pp. 3–28, figs. 11*).—A general discussion of the principal factors affecting the successful production of lespedeza in the State, together with notes on weeds and insect pests. Improved varieties developed by the station are described and illustrated. It is noted that on the thin gray land at the West Tennessee Substation commercial fertilizers did not influence yields appreciably, but a marked increase resulted from liming.

Field peas for Wisconsin, E. J. Delwiche (*Wisconsin Sta. Bul. 329 (1921), pp. 24, figs. 11*).—A general discussion of the production and utilization of field peas in Wisconsin. The average yields for the period 1908 to 1917, inclusive, indicate that the crop pays better per acre than barley, oats, rye, wheat, or hay. The best varieties, as indicated in tests, are pedigree strains of Green, Scotch, and Marrowfat.

Potato improvement by hill selection, G. Stewart (*Utah Sta. Bul. 176 (1920), pp. 3–28, figs. 14*).—Progeny tests of the power of a strain of potatoes to transmit its desirable qualities to succeeding generations are described. From 1911 to 1913 high and low yielding hills, selected from three potato varieties, Bangor, Peerless, and Majestic, were planted in individual progeny rows and each hill harvested separately. Bangor and Peerless stocks were discarded in 1914 on account of inferior yielding power. Similar selections were continued from the Majestic variety until 1916, but thereafter only high-yield selections were made, with the exception of a few strains developing unusual foliage characters. Selection for gametic qualities was sought and somatic factors avoided.

By 1915 the high-yielding strains averaged 301 bu. per acre, as compared with 179.3 bu. for unselected. The six-year average (1915–1920) acre yield of the selected strain was 60.9 per cent greater and the average size of the tuber 24.4 per cent greater than those of the unselected stock. After the best tubers had been selected for seed, remnant hills and strains gave a yield somewhat poorer than unselected stock. Selected strains produced higher acre yields, more tubers per hill, larger individual tubers, and a higher percentage of marketable potatoes than the unselected stock. The germination of the selected strain was more rapid, the stand better, the growth thriftier, and diseases less apparent than for the unselected potatoes of the same variety.

Wisconsin rye, R. A. Moore and B. D. Leith (*Wisconsin Sta. Bul. 326 (1921), pp. 19, figs. 7*).—A general discussion of the practices involved in the production of rye in Wisconsin is presented, together with notes on the place of the crop in rotations, utilization, and the control of ergot.

In 1919 over 8,000,000 bu. of rye was produced in Wisconsin. The largest production is in the central and northwestern parts of the State, especially on the sandy areas. Comparisons of the 9-year average acre yields of the leading small grains at the station showed the pedigree varieties to rank as follows: Schlanstedt winter rye, 47.1 bu.; Turkey Red winter wheat, 37 bu.; Oderbrucker barley, 46 bu.; and Wisconsin Wonder oats, 75.7 bu.; or 2,638, 2,220, 2.208, and 2,422 lbs. per acre, respectively. Spring rye is not recommended on account of lower yields than the winter type, the 3-year average acre yield of two varieties of spring rye being 23.9 bu., of 47.4 lbs. weight, as compared with 44.1 bu., of 54.8 lbs. weight, from two varieties of winter rye.

Report on the sugar-cane experiments for the season 1918–1920, R. R. Hall and J. R. Bovell (*Barbados Dept. Agr., Rpt. Sugar-Cane Expts., 1918–1920, pp. 77*).—Variety and fertilizer tests with sugar cane in Barbados are reported in continuation of previous work (E. S. R., 42, p. 234). Results of tests of seedlings, plant and ratoon canes, and selected varieties of sugar cane grown on various experimental plats on different estates, and meteorological data are reported as usual in tabular form. The presence of the root borer (*Diaprepes abbreviatus* L.) and the brown hardback (*Phytalus smithi* Arrow) on the fertilizer plats rendered the results inconclusive.

Cuttings of large canes and small canes produced respective average acre yields of 29.48 and 26.88 tons of cane. In canes on which the tops were withered from attacks of the root borer and brown hardback, large cane cuttings produced 31.11 tons, as compared with 24.15 tons from small canes. Cuttings from healthy cane made 31.19 tons per acre and those from canes attacked by the moth borer (*Diatræa saccharalis* Fahr.) 33.86 tons. In each case canes not withered gave greater yields than those withered from attacks of root borer and brown hardback. On the other hand, canes from cuttings attacked by the moth borer gave better results than cuttings from canes not attacked by this insect. Cuttings from plant canes and first and second ratoons made average acre yields of 28.39, 26.95, and 28.32 tons, respectively.

Leading varieties in tests on plats in black soil districts with their acre production of muscovado sugar include Ba. 8409, 7,358 lbs.; B. S. F. 12(48), 7,158 lbs.; and Ba. 11403, 6,732 lbs.; as compared with White Transparent with 4,018 lbs. On red soils the leading varieties with tons of cane per acre include Ba. 6032, 32.05 tons; Ba. 12079, 32.02 tons; and B. H. 10(12), 30.67 tons. White Transparent, the standard cane, made 20.74 tons.

In tests of selected varieties for the years 1916–1920, inclusive, on black soil with plant cane, the highest yielding varieties with their yields of muscovado sugar were B. H. 10(12), 7,716 lbs.; Ba. 11403, 7,346 lbs.; and Ba. 6032, 7,146 lbs. White Transparent was twenty-third among the varieties, giving an average yield of 5,735 lbs. during the period. On red soil Ba. 6032, B. 6450, and Ba. 2471 were first, making yields of 37.44, 33.3, and 31.89 tons of cane per acre, respectively.

Annual white sweet clover and strains of the biennial form, A. J. Pieters and L. W. Kephart (*U. S. Dept. Agr., Dept. Circ. 169 (1921). pp. 21, figs. 8*).—The occurrence of annual white sweet clover, its growth, flowering habits, and uses are described, and the seed, plants, and growth habits of the annual and biennial forms of *Melilotus alba* compared. Notes on annual blossoming biennial forms, varieties and strains of the biennial form, and Grundy County and Arctic sweet clovers are also included. Earlier work with this clover has been noted (E. S. R., 44, p. 431).

The annual differs from the biennial form in its more rapid growth and maturity. Crown buds are not developed, but the plant dies after producing seed. When two or more crown buds develop on a biennial, the habit of the

plant when in seed is distinct from that of a seed-bearing annual, but when only one crown bud develops, the biennial and the annual seed-bearing plants can not be distinguished with certainty. Seeds of the annual can not be distinguished from those of the biennial form.

Teff grass (Eragrostis abyssinica), J. BURTT-DAVY (*Johannesburg: Author, 1916, pp. 36, figs. 5*).—This publication treats of the history, geographical distribution, description, and uses of teff grass (*E. abyssinica*), and the cultural and field practices involved in its production in South Africa. See also earlier notes (E. S. R., 28, p. 738; 34, p. 435). A bibliography of 25 titles is appended.

[In a later communication the author states that "in 1919 the Union of South Africa grew just under 250,000 acres of teff, worth to the farmers of the country over £1,000,000. Teff hay has sold as high as £15 per ton (2,000 lbs.) in the Johannesburg market. These facts have come to light since the pamphlet was published."]

Connecticut Round Tip tobacco: A new type of wrapper leaf, D. F. JONES (*Connecticut State Sta. Bul. 228 (1921), pp. 285–292, pls. 2; also in Tobacco, 72 (1921), No. 2, pp. 5, 24, 25, figs. 4*).—A new type of wrapper leaf for priming, developed by 10 years of selection and testing at this station. The plant is described as a tall and vigorous grower, flowering and setting seed abundantly, and possessing a stronger root system than Havana. The leaves, 20 to 24 per plant, are smaller and more compact than Broadleaf. The length of leaf ranges from 16 to 26 in., but on account of the broad round shape, a 20-in. leaf is equal to a much larger leaf of either Havana or Broadleaf, and yields a greater number of wrappers pound for pound. Yields ranging from 1,600 to 2,000 lbs. per acre have been secured. Opinions of tobacco growers are appended.

Varieties of winter wheat adapted to the eastern United States, C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul. 1168 (1921), pp. 18, figs. 5*).—A revision of the material included in Farmers' Bulletin No. 616 (E. S. R., 32, p. 336).

Results of seed tests for 1920, M. G. EASTMAN (*New Hampshire Sta. Bul. 197 (1920), pp. 16*).—A report on the purity and germination of 563 official samples of agricultural seed collected during the year ended July 1, 1920.

HORTICULTURE.

[Report on horticultural investigations] (*Indiana Sta. Rpt. 1920, pp. 25–28, 29*).—This is mainly a progress report (E. S. R., 43, p. 337).

In the soil management investigations in the apple orchard at Laurel, Ind., the trees in the tillage and straw mulch plats continue to make the best growth. "Plats in grass but receiving grass mulch are next, and those in straight grass are making the poorest growth. The plat which was tilled the first five years and then seeded to grass made less growth during 1919 than the plat which had been planted in grass from the beginning of the experiment, but which has received additional mulch of straw since 1917, continues to show increased growth. The annual trunk gain made last year was nearly equal to that made by the plat which has received straw mulch since the beginning of the experiment. This plat, together with the plat which was seeded to grass after five years of cultivation, again emphasizes the rapidity with which trees will respond to changes in soil management.

"The first real crop of fruit was produced on these plats in 1919, although late spring frosts and heavy winds reduced the yield at least one-half. Production follows in direct proportion to growth and we find the cultivated and mulched plats leading in both growth and production. The production in 1919 on these two plats was practically seven times that of the straight grass plat.

Only 65 per cent of the trees on the grass plat fruited, while practically all under tillage and straw mulch fruited in 1919. Fertilizers on these plats showed beneficial effect, principally upon the cover crop and grass, but did not show noticeable results in fruit production."

Pruning experiments at Laurel, Bedford, and LaFayette gave additional evidence that heavy pruning of young trees not only reduced the size of the top but reduced the total growth of the root system as well. At Bedford, where half of a block of 4-year-old trees is under cultivation and half under sod, the tilled trees made 126 per cent greater gain in girth than trees in sod, whereas lightly pruned trees made 48 per cent more growth than heavily pruned trees, thus indicating that soil treatment has a greater effect on growth than pruning treatment.

Data secured in the dusting experiment at Peru confirmed the results of the previous year, namely, that dusting is more expensive and slightly less effective in controlling apple scab. Dusting controlled curculio and codling moth as effectively as spraying.

In orchard fertilization tests, nitrate of soda had little effect in three orchards under cultivation, but increased the yield of fruit 27 per cent in one orchard in sod.

Tomato fertilization experiments in 1919 indicate that the use of acid phosphate, in combination with nitrogen and potassium, is more profitable than acid phosphate alone. "Of some 15 different combinations of fertilizers 500 lbs. of a 2 : 12 : 6 gave the highest net profit. Six hundred lbs. of acid phosphate per acre alone yielded a net profit of $24.54 per acre, while a fertilizer of the above formula gave a net profit of $44.45 per acre. Check plats in this experiment showed a net loss in every instance. This loss was as high as $10.68 per acre. This work is being continued."

Indiana-grown onion seed was found to be equal to commercial stocks. Similar results were indicated in studies with Country Gentleman and Stowell Evergreen sweet corn and Irish Cobbler potatoes.

Studies in sweet pea germination indicated that sand is the best medium for varieties which ordinarily show poor germination. A higher percentage of germination was usually obtained under low temperatures, although high temperatures as in a rose house may hasten germination. Soaking seed in warm water for 18 hours proved highly satisfactory, but sulphuric acid is not recommended. Large seeds of all varieties gave better germination than smaller seeds of the same varieties.

The vegetable garden, J. G. Moore (*Wis. Agr. Col. Ext. Circ. 132 (1921), pp. 36, figs. 12*).—Detailed instructions are given for the planning, planting, and care of the home vegetable garden. Directions for the storage of vegetables are included.

Vegetable growing, S. C. Hartman (*Ohio Sta. Bul. 344 (1920), pp. 362–366, figs. 2*).—Brief notes are given of the cost and returns per acre of cabbage, sweet corn, cucumbers, and tomatoes grown on the Washington County Experiment Farm.

The handling and transportation of cantaloups, A. W. McKay, G. L. Fischer, and A. E. Nelson (*U. S. Dept. Agr., Farmers' Bul. 1145 (1921), pp. 28, figs. 10*).—This is a revision of Markets Documents 9 (E. S. R., 39, p. 240), and 10 (E. S. R., 39, p. 444).

Evaluation of climatic temperature efficiency for the ripening processes in sweet corn, C. O. Appleman and S. V. Eaton (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 795–805, fig. 1*).—A contribution from the Maryland Experiment Station, dealing with the chemical changes in sweet corn during ripening and the effect of climatic temperature on the rate of these changes.

In a previous paper (E. S. R., 41, p. 646) the senior author and Arthur pointed out the rapid loss in sugars following the removal of the ear from the growing plant.

In this experiment an early and a late crop of Stowell Evergreen were used. Samples of kernels were taken at 48-hour intervals, commencing with the earliest usable stage of maturity. The late crop required 15 days to attain the same stage of maturity that the early crop reached in 6 days.

Data are presented in tabular form showing changes in composition of sweet corn during ripening, a comparison of early and late crops of sweet corn in respect to changes in percentage composition in equal lengths of time, temperature indices in relation to ripening of sweet corn, comparison of the rates of sweet corn ripening in different localities based upon the exponential indices corresponding to the normal mean temperatures of the ripening seasons, and the rate of sweet corn ripening during the month of August calculated from Baltimore temperatures. The authors point out the practical value of their experiments in determining the number of days that a crop of corn is in proper condition for harvesting.

The chilacayote or Siam gourd, L. T[RABUT] (*Rev. Hort. Algérie, 25 (1921), No. 2, pp. 17–19*).—A paper directing attention to the merit of this gourd as human food, and pointing out that despite the generally accepted idea of Asiatic origin this plant is a native of America.

Standard containers for fruits and vegetables, F. P. DOWNING (*U. S. Dept. Agr., Farmers' Bul. 1196 (1921), pp. 34, figs. 33*).—A contribution from the Bureau of Markets, presenting a study of containers used for marketing vegetables and fruits. The multiplicity in size and shape of containers is illustrated by photographs and tabulations of dimensions. It is pointed out that these variations have been the cause of much confusion, loss, and opportunity for fraud. The Federal laws regulating size of barrels, grape baskets, berry boxes, and till baskets are said to have done much for standardizing the marketing of certain fruits and vegetables, and further acts to include the bushel package and other receptacles are recommended and urged.

A handbook of hardy fruits more commonly grown in Great Britain, E. A. BUNYARD (*London: John Murray, 1920, pp. 205*).—An alphabetically arranged manual of apple and pear varieties, largely a compilation from other sources but supplemented with the author's observations and notes. Group classifications of varieties are included.

The annual review of new fruits, U. P. HEDRICK (*Rural New Yorker, 80 (1921), No. 4628, pp. 355, 360, figs. 4*).—A popular article directing attention to several new and meritorious varieties of fruits, a large proportion of which were originated at the New York State Experiment Station.

The handy book on pruning, grafting, and budding, J. UDALE (*Evesham [England]: W. & H. Smith, Ltd., Journal Press, 1920, 4. ed., rev. and enl., pp. 146, figs. 80*).—A treatise on the principles and practices of pruning fruit and ornamental plants and on grafting and budding. The introduction is by Cobham.

Bud selection with special reference to the apple and strawberry, V. R. GARDNER (*Missouri Sta. Research Bul. 39 (1920), pp. 3–30*).—A report of bud selection studies with the apple and strawberry at the Missouri Station and with the strawberry at the Oregon Station. An earlier paper has been noted (E. S. R., 43, p. 536).

The Missouri experiments were begun in 1895 and conducted over a period of 23 years. The materials utilized were Ben Davis apple trees, propagated from the highest and lowest yielding trees in an orchard of over 200 individuals, and strawberry plants, propagated from highest and lowest yielding individuals of

a single variety. The results of the Missouri experiments, previously noted (E. S. R., 33, p. 236), are summed up by the author, as follows:

"The apple trees propagated from the high-yielding parent averaged about the same in quantity and grade of fruit produced as those propagated from the low-yielding parent. The two lots of trees alternated with each other in their seasons of heavy and light bearing. There was a large amount of variation between the individual trees in each lot. Ten successive generations of runner selection from high-yielding and from low-yielding strawberry plants at the Missouri Station failed to produce strains whose yield was higher or lower than the average of the variety."

The Oregon experiment, begun in 1913 and extending over a period of five years, is reviewed in detail. Productive and unproductive individuals of several strawberry varieties and seedlings were selected in 1913 and 1914, and with the exception of 1915, when frosts destroyed the crop, careful records were made of the yield of the original selections and their progeny. These records are presented in tabular form. "When the variations due to seasonal and other more or less obvious causes are accounted for, it is evident that on the whole there has been very little difference in the yields that have been obtained from the daughter plants of high-yielding and those of low-yielding individuals. The daughter plants of low-yielding individuals outyielded those of high-yielding individuals as often as they underyielded them. . . .

"Apparently most of the individuals chosen as starting points for the bud-selection work, like those chosen by the Missouri Station, simply represented extreme degrees of development that were in the nature of fluctuating variations—variations that could not be perpetuated by bud propagation. On the other hand, the selections made from Station Seedling No. 87 produced runners that did show a marked tendency to perpetuate the high and low producing qualities of the mother plants. . . . Selection B of this variety was barren the first year, and the second year it produced only a single flower cluster, while selection A was moderately productive. For three successive seasons the daughter plants of selection A yielded practically twice as much as those of selection B. The low yield of the daughters of selection B was due to two factors: (1) Some of these daughter plants bore nothing at all, remaining barren; (2) those which did produce bore lightly. . . . Evidently here was the beginning of two distinct strains, a productive or normal strain and an unproductive or semibarren strain. In this one instance bud selection had served to segregate these two forms. It is interesting to note in passing that the variation from the normal form, which in this case could be perpetuated, was in the direction of deterioration or degeneration. From a practical viewpoint, all bud selection accomplished was to keep the variety up to its own standard by the weeding out of an infertile or semibarren strain."

Observations made upon the sudden loss of vigor in all or part of the individuals of certain station seedling strawberries are included and discussed by the author, who concludes that this degeneration is a form of bud variation. A notable variation in the vigor of five lots of Marshall strawberry plants, obtained from widely separated sources, led the author to advise greater care in the testing of accessions, allowing reasonable time for acclimatization.

Crosses made in 1914 between the Wilson variety and plants of the wild *Fragaria chiloensis* yielded one seedling plant which bore two kinds of petioles, one with spreading and one with appressed and ascending pubescence. Of 79 stoloniferous progeny obtained from this plant in 1915, 75 were like the mother, 2 had petioles bearing appressed and ascending pubescence, and 2 had petioles with spreading pubescence. The author terms the condition of the mother plant as that of "divided dominance" and adds: "Of course, these particular bud

variations are of no value either to the strawberry grower or the strawberry breeder, but they are interesting in that they show that strains may arise in the strawberry through bud variation which are not in the nature of degenerate forms and which theoretically at least might be the means of providing improved strains."

Renewing old orchards in Kentucky, first year results in a five-year program, H. R. NISWONGER (*Ky. Agr. Col. Ext. Circ. 90 (1921), pp. 15, figs. 8*).—A report of demonstrations in seven neglected Kentucky farm orchards varying in size from 18 to 125 trees and in age from 12 to 20 years. The trees were pruned, sprayed, and the soil improved by application of manure at the rate of 1 ton for three trees or, where no manure was available, nitrate of soda at the rate of 5 to 8 lbs. per tree, dependent on the age of the tree. Cost of all renovation operations are presented in tabular form and summarized, showing an average net profit of $1.53 for each of the 387 trees involved.

Dusting v. spraying for insect control, T. J. HEADLEE (*Peninsula Hort. Soc. Del.] Trans., 34 (1921), pp. 51–60, fig. 1*).—This paper discusses the comparative merits of dusting and spraying for the control of insect pests and records experiences in New Jersey during the years 1919 and 1920. A chart is included graphically illustrating the relation of New Jersey rainfall in 1919 and 1920 to the time of application of dusts and the periods during which such applications must remain on the tree to be effective. Heavy rains were found to wash off the dust promptly and light rains to be harmful when extending over a long period. Dusting experiences of 1919 and 1920 show a marked correlation between the presence or absence of heavy rains and the number of codling moth worms.

The author concludes in part that, "the best that can be claimed for the dust under most favorable average conditions is that it is about as good as the spray, and this seems to indicate that the unreliability is upon the side of the dust. In New Jersey the evidence in favor of greater efficiency on the part of the liquid applied materials is clear and definite for control of curculio and codling moth. The failure of the dust in the New Jersey experience in 1919 and 1920 seems to be chargeable to its having been washed off the tree, either by small rains covering a long period or by heavy rains covering short periods."

Dusting experiments in peach and apple orchards in 1920, F. D. FROMME, E. S. RALSTON, and J. F. EHEART (*Virginia Sta. Bul. 224 (1921), pp. 12, figs. 2*).—A further report on dusting investigations in Virginia orchards (E. S. R., 42, p. 345).

"The work on peaches was conducted in three orchards at Crozet, Va. There were five plats in each orchard, three were dusted with sulphur dust, one was sprayed with arsenate of lead and self-boiled lime sulphur, and one served as a check. The number of applications on the dusted plats varied from 5 to 8, the plat receiving 5 applications, one 6, and one 8. The number of applications on the spray plats was 3, which is the standard schedule for this State." Data were obtained from counts of all peaches from six trees of each plat and are presented in tabular form.

"Scab was the most prevalent disease and the injury caused by the green soldier bug the most prevalent insect injury. Brown rot, unfortunately, was light in all three orchards. The extra number of dust applications were planned with the control of this disease in view. Next to scab, the most common cause of defective fruits was a type of cracking, which was largely confined to the dust plats." The authors state that this injury was apparently due to a combination of factors, excessive dust materials, and unusual weather conditions; and the results of a single season should not be accepted as a judgment against dusting. Curculio infestation was too slight to indicate the

efficiency of the material. "Our experience with peach dusting, therefore, may be summed up in the statement that the dusting materials have given very satisfactory control of scab, and that the data with respect to the control of brown rot and curculio are insufficient for drawing conclusions."

The experiments on apples were conducted in two orchards, one at Harrisonburg, where the control of scab was the principal object, and one at Crozet, where bitter rot was the chief disease. In the Harrisonburg orchard, composed of 11-year-old Winesap and Stayman trees, scab had been very severe in 1919. Seven applications were made on all the treated plats. "Scab was the only disease present to any extent. There was no bitter rot whatever, and codling moth was so slight as to be negligible. The few wormy apples were quite uniformly distributed over the plats. . . . Scab infection on Winesap was considerably more severe than on Stayman, about three times as much on the average. This is due to the difference in the susceptibility of the two varieties.

"All three spray mixtures gave good control of scab, the Bordeaux mixture being apparently somewhat less efficient than the other two. Unfortunately, there was no fruit of the Winesap variety in the lime sulphur plat and not enough in the dry lime sulphur plat (only 68 apples) to serve as a basis for conclusions. The sulphur dust was by far the most efficient of the three dust mixtures, and this material compared very favorably with the spray mixtures in scab control, the percentages of efficiency being 88 for Winesap and 92 for Stayman. Neither the copper-lime nor Bordeaux dust gave sufficiently good control of scab to warrant their use, and both caused some russetting of the fruit. Some russetting was present in all of the spray plats also, but it was not severe enough to be commercially important. The sulphur dust was the only material that did not cause russetting."

The Crozet orchard consisting of 30 large Albemarle Pippin trees was divided into four plats, one of which was sprayed with lime sulphur followed by applications of Bordeaux, with lead arsenate used in the first three of the total six treatments; two plats were dusted with copper-lime mixture in proportions of 10:10:80 and 5:10:85; and one plat served as control. Although bitter rot was not especially severe, an adequate test of the materials was obtained. Codling moth was much more severe than in the Winesap and Stayman orchard. "Neither of the copper-lime mixtures proved at all satisfactory from the bitter rot standpoint. By comparison with the check they apparently did not have any value whatever in the control of this disease. The Bordeaux spray, on the other hand, gave almost perfect control and reduced bitter rot infection to a negligible amount. The spray applications were also more effective in the control of codling moth than the copper-lime dust."

A summary of results for 1917, 1919, and 1920 is shown in tabulated form and leads to the following observations: "None of the dust mixtures has proved sufficiently effective in the control of bitter rot to warrant its use. . . . It is apparent that none of the dust mixtures should be used in orchards where bitter rot is apt to be prevalent. There seems to be no justification for the use of any of the copper dusting mixtures in Virginia apple orchards. The sulphur dust mixtures, the 40:40:20 in 1917 and the 80:10:10 in 1919, have proved practically as efficient in the control of codling moth as the corresponding spray materials. This is also true for the Bordeaux dust, but the copper-lime dusts have not proved as effective as the spray mixtures."

Experiments in dusting and spraying peaches for the control of curculio, brown rot, and scab, O. I. SNAPP and L. PIERCE (*Mississippi Sta. Bul. 195 (1920), pp. 8*).—A report of a single season's investigations conducted in cooperation with the station by the U. S. Department of Agriculture near New Albany, Miss., in which a study was made of the comparative efficiency of dust

and spray for the control of curculio, brown rot, and scab of the peach. The 716 Belle of Georgia and Carman peach trees utilized in the experiment were divided into seven nearly equal plats, five of which were treated with dusts, one with spray, and one left untreated as check. Results were determined by counts of sound and unsound fruits on 10 central trees of each plat and by gross yield of the entire plats.

Of the six treated plats, the spray gave the highest percentage of No. 1 commercial fruits and next to the highest percentage of sound fruits. The dust mixture of 10 per cent lead arsenate, 10 per cent lime, and 80 per cent sulphur, when used in all three applications, gave the highest percentage of sound fruit, but its use resulted in serious defoliation and consequent loss of quality in the fruits. A dust mixture in which 15 per cent lead arsenate was used in two of the three applications also caused serious defoliation, leading the authors to conclude that this percentage of lead arsenate can not be safely used on peach foliage. A study of the cost of dusting *v.* spraying resulted in the conclusion that, when the cost of application of material is considered, there is little difference. Dust and spray calendars are included.

Desirable cherries for cultivation, L. Chasset (*Rev. Hort.* [*Paris*], *93* (*1921*), *No. 16, pp. 274, 275*).—Brief notes on varieties of cherries deemed worthy of more extended use.

Specific results in pollinating the Bartlett pear, W. P. Tufts (*Better Fruit, 14* (*1919*), *No. 3, pp. 5, 21, 22, figs. 2*).—A popular presentation of investigations already noted from another source (E. S. R., 41, p. 240).

A native prune, L. R. Detjen (*Peninsula Hort. Soc.* [*Del.*], *Trans., 34* (*1921*), *pp. 37–42*).—Attention is directed to a supposedly new variety of plum, named by the author the Herald, which although apparently of native American stock has the prune characteristics of clinging to the tree and drying without decaying. The author describes the dried fruit as of inferior quality, but points out the potential value of the variety as a possible founder of a new race of prunes.

Varieties of grapes, J. C. C. Price (*Alabama Col. Sta. Bul. 211* (*1920*), *pp. 35–50, figs. 15*).—A variety test of grapes begun in 1912 is reported.

"The following 11 varieties remained healthy throughout the six years' test and produced good crops of fruit, showing their ability to withstand adverse conditions, and should be selected for either home or commercial planting in Alabama: Brighton, Catawba, Concord, Delaware, Diamond, Ives, Isabella, Moore, Niagara, Worden, and Winchell." Six varieties of rotundifolia grapes included in the trial proved of value. "The Scuppernong, a name applied to all greenish white rotundifolia grapes, is especially prized for eating out of hand; the Eden and Misch for their peculiar, musk flavor; the James for its immense size; the Thomas for its extra value for culinary purposes; and the Flowers for its late ripening period. This class of grapes has a longer season than the bunch grapes and should be more generally grown. Its season is later than bunch grapes, thus prolonging the period for fresh grapes."

Brief descriptive notes are given for the 54 varieties tested.

"Yema" budding of the vine, H. L. Manuel (*Agr. Gaz. N. S. Wales, 32* (*1921*), *No. 3, pp. 197–199, figs. 3*).—A brief article on the merits of the "Yema" method of grafting the grape. In contrast to the usual process, this operation is performed in summer after the strong flow of sap has ceased, and instead of cutting off the plant at the surface of the ground a chip bud is inserted in a prepared groove and the stock allowed to grow until the bud is established. This process is valued in phylloxera-ridden areas.

[New small fruits and grapes], R. WELLINGTON (*Canad. Hort., 44 (1921), No. 5, pp. 73, 74, fig. 1*).—Attention is drawn to several new varieties of strawberries, raspberries, and grapes which, according to the author, show sufficient merit to warrant their trial by fruit growers.

The Colombian berry or giant blackberry of Colombia, W. POPENOE (*Jour. Heredity, 11 (1920), No. 5, pp. 195–202, figs. 5*).—A popular account of a large-fruited species of Rubus found growing wild in the highlands of Colombia, with notes concerning botannical nomenclature and description of plant and fruit.

Pineapple culture in Cuba, B. MUÑOZ GINARTE (*Estac. Expt. Agron. Cuba Bol. 45 (1919), pp. 48, figs. 16*).—A comprehensive and practical bulletin on the pineapple-growing industry in Cuba. Soil requirements, varieties, propagation, cultural practices, fertilizers, insect and fungus pests, harvesting, marketing, returns, and methods of utilizing the fruit are among the points discussed.

The cultivation and uses of roselle, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 89–99, pls. 5, fig. 1*).—This paper contains practical information relative to the roselle, its introduction and behavior in the Philippines, varieties, culture, uses, etc., including recipes.

[Economic plants in Uganda], J. D. SNOWDEN, C. HAZEL, and W. SMALL (*Uganda Dept. Agr. Ann. Rpt., 1920, pp. 15–20, 22, 24–28, 42–44*).—Cultural and varietal experiments with cacao, coffee, and tea are reported, together with results of tapping experiments with Hevea at Entebbe and Kampala. A list of various fruit and economic plants cultivated at Kampala is included.

Pecan pollen, E. E. RISIEN (*Amer. Nut. Jour., 14 (1921), No. 5, p. 54*).—Brief notes are given of the author's methods of technic in pecan breeding. In place of the usual paper sack for covering the pistillate flower, the bloom is inclosed in a capsule attached to a branch by a fine copper wire. Fertilization is obtained by placing within the capsule a small amount of absorbent cotton previously dipped in the pollen of the desired variety. The author states that he has repeatedly fruited new seedlings in five years from seed.

Ginseng culture, W. W. STOCKBERGER (*U. S. Dept. Agr., Farmers' Bul. 1184 (1921), pp. 15, figs. 3*).—A revision of Farmers' Bulletin 551 (E. S. R., 29, p. 639).

The importance of plant quarantine service in the Philippines, G. MERINO (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 117–125*).—A paper pointing out the importance of plant inspection service to the Philippines. Previous to the inauguration of the service, in 1915, many disastrous pests had been introduced, for example, coffee blight. The organization and operation of the Philippine inspection service is discussed and compared to that of Japan in an effort to emphasize the necessity of improving and extending the service.

FORESTRY.

Studies in forest tree seeds: Relation between germination and soil moisture, E. N. MUNNS (*Natl. Nurseryman, 29 (1921), No. 5, pp. 115–117, figs. 4*).—A report of investigations concerning the relation between germination of forest tree seeds and the amount of moisture in the soil. The work was carried on at the Converse Experiment Station of the U. S. Forest Service in Southern California, and extends over the period 1915–1920.

The maintenance of soil moistures of 10, 15, and 20 per cent in seed beds of yellow pine (*Pinus ponderosa*) resulted in germinations of 41, 78, and 93 per cent, respectively, with marked variations in rate. A further test in cans of sand, in which the moisture ranged from 5 to 40 per cent at 5 per cent inter-

vals, gave respective germinations of 6, 38, 95, 87, 69, 26, 3, and 0 per cent. Similar tests with several other species led the author to observe that each species evidently has an optimum range of soil moisture for the germination of its seeds. A fluctuation in the moisture content resulted in decreased germinations of both *P. ponderosa* and *P. jeffreyi* and in a longer time required for germination.

The author points out the possible value of his study in solving certain forest problems. The data relative to the various species are illustrated by graphs.

Determination of the increment of trees by stem analysis.—I, Eucalyptus viminalis Labill., W. A. W. DE BEUZEVILLE (*Roy. Soc. N. S. Wales, Jour. and Proc. 53 (1919), pp. 239–245, figs. 6*).—In this paper, presenting an analytical study of a typical tree of *E. viminalis* in which the diameter and age was determined at various heights, age was based on the number of concentric rings, assuming that each ring represented one year's growth. The data, presented in tabular form and graphically delineated by means of curves, show the relation of height, diameter, volume in cubic feet, and rate of increment of volume to age. The correlation of height and volume to diameter is also illustrated.

Adaptation in Douglas fir, J. V. HOFMANN (*Ecology, 2 (1921), No. 2, pp. 127–131*).—Studies are reported concerning the transmission of inherent tendencies in the Douglas fir. Modifications of the parent trees due to soil, age, elevation, locality, health, and density of stand were found to exert an influence on the vitality of the seed and in some measure on the growth of the seedlings. The data, based on six annual germination tests and on the growth of one-year seedlings from each test, are presented in tabular form.

"The outstanding conclusion is that the variations in vitality of seed and vigor of seedlings, caused by the environmental condition of the parent tree, are not sufficiently pronounced to justify radical methods of management which may favor one or another of the factors. In so far as seed production, vitality of seed, and vigor of seedlings are concerned, there need be no selection of seed trees based on age, health, or soil in which they are growing which will in any way interfere with the best economic utilization of the stand." A general tendency was found for seed to decrease in vitality as the age of the parent increases.

The Macedonian pine (Pinus peuce), S. MOTTET (*Rev. Hort. [Paris], 93 (1921), No. 14, pp. 244–246, figs. 2*).—This article contains brief descriptive notes on this little-known species of pine.

Notes on Eucalyptus, VII, VIII, J. H. MAIDEN (*Roy. Soc. N. S. Wales, Jour. and Proc., 53 (1919), pp. 57–73, 107–115*).—In continuation of previous articles (E. S. R., 42, p. 348), further notes are given on Eucalyptus species and six new species are technically described.

[Cultivated timber trees for South Africa], T. R. SIM (*So. African Jour. Indus., 3 (1920), Nos. 9, pp. 783–793; 10, pp. 950–958; 11, pp. 1030–1039; 12, pp. 1155–1172; 4 (1921), Nos. 1, pp. 65–75; 2, pp. 161–165*).—A discussion of forest-tree species which have demonstrated their value for South African conditions. The timber requirements of South Africa, the geographical areas from a forest viewpoint, and the superior value of exotic to indigenous species are discussed in the initial article. A list of tried and recommended species is presented in tabular form and enlarged with a discussion of the habits, qualities, and requirements of the various trees.

Swedish forests, lumber industry, and lumber export trade, A. H. OXHOLM (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 195 (1921), pp. 282, pls. 53, figs. 32*).—This contribution presents comprehensive information on the forests, lumber industry, and lumber export trade of Sweden,

based on eight months' first-hand observations by the author. The subject is treated under three general headings: (1) Forest resources and logging and floating operations, (2) lumber manufacture, and (3) the lumber export trade. Appendixes giving the imports and exports of lumber in tabular form are included. The text is well illustrated by photographs and maps.

Lumber markets of Spain and Portugal, N. C. Brown (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 201 (1921), pp. 151, pls. 15, fig. 1*).—This contribution presents a detailed study of the lumber markets of Spain and Portugal, especially in relation to present and future needs and means of increasing and improving the trade from the United States. Statistical tables relating to imports of lumber into Spain and Portugal are included.

Eighth biennial report of the State Board of Forestry of the State of California, G. M. Homans (*Calif. State Bd. Forestry Bien. Rpt., 8 [1919–20], pp. 64, figs. 6*).—In this, the usual biennial report (E. S. R., 40, p. 744), a forestry policy is outlined in which fire protection is deemed of major importance. The proceedings of a conference on conservation between the State board and the lumbermen of the State are included. Information is also presented relative to the State fire organization in 1919 and 1920, forest and grain and hay fires, 1916–1920, the State nursery, highway planting, educational and experimental work, and finances.

[Report of the] division of forestry, R. D. Forbes (*La. Dept. Conserv. Bien. Rpt., 4 (1918–1920), pp. 43–63, pl. 1, figs. 5*).—The usual biennial report along the lines of forest fire protection, investigations, and educational activities (E. S. R., 39, p. 450). A statistical appendix is included, giving data relative to timber resources, forest fires, etc.

Report on forest administration in the Andamans for the year 1918–19, W. R. Leg. Jacob (*Andamans Forest Admin. Rpt. 1918–19, pp. [3]+VII+38*).—This is the customary report (E. S. R., 39, p. 547).

Progress reports of forest administration in the Jammu and Kashmir State for the years 1916–17 and 1917–18, B. O. Coventry (*Jammu and Kashmir [India], Forest Admin. Rpts., 1916–17, pp. II+23+LI; 1917–18, pp. II+23+LIV*).—The usual annual reports (E. S. R., 37, p. 650).

DISEASES OF PLANTS.

[Plant disease investigations] (*Indiana Sta. Rpt. 1920, pp. 15–17*).—The occurrence of a new bacterial disease of tomatoes is reported, the disease being characterized by spotting of the leaves, stems, and fruits. Leaf and stem infection may cause serious injury to the plants, but the greatest damage is said to be due to the black, scabby spots occurring on the fruit. Practically all varieties of tomatoes are said to be susceptible. It is believed that the spread of the disease under field conditions is effected largely through insects. The bacteria causing the disease are said to be very resistant to drying and are carried over winter dried on the surface of the seed. Numerous tests with heavily inoculated seed has proved that a 5-minute immersion in a 1:3,000 solution of corrosive sublimate kills all the bacteria and does not injure the seed.

Field observations are said to have shown that tomato mosaic is an important disease in Indiana. It has been found that the disease attacks the ground cherry and apparently lives over winter in the rootstock of this plant.

Field investigations indicated that the disinfection of potato tubers with corrosive sublimate or formaldehyde will control the scab and black scurf of potatoes. A brown discoloration of the vascular system at the stem end of potatoes was found to be due to a species of Fusarium, and it is considered advisable to

test all tubers by cutting the stem end and discarding those showing discoloration as a means for the prevention of the Fusarium wilt. A test of seed potatoes secured from Maine and planted in two localities in Indiana is said to indicate that mosaic disease may be present in the Indiana potato crop without showing typical symptoms, and it is thought that this may be the cause of the low yields secured in some localities.

Notes are given on some onion diseases, and the formaldehyde drip method for the control of smut is advocated. Anthracnose, pink rot, and Fusarium bulb rot are also said to be found in some localities. A nonparasitic trouble, which is attributed to an excess of soluble salts, is said to cause considerable irregularity of stands of onions in some soils.

In continuation of work on the foot rot of wheat, one season's investigations are said to indicate that the disease persists in the soil, 26 per cent of the plants being infected when grown on previously infected lands.

From the results of experiments carried on in 1919, it appears that the dormant spray does not diminish blotch infection on the fruit and foliage of apples.

Sulphur as a fungicide, B. T. P. Barker, C. T. Gimingham, and S. P. Wiltshire (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 57–75; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 144–163*).—This account of investigations on the fungicidal action of sulphur and certain of its compounds, which were begun early in 1919, though regarded as a preliminary report, presents in condensed form results of many series of experiments, which have covered a very wide field.

The central problem of the investigations here recorded was to determine how sulphur acts as a fungicide, the question of the action of sprays of the sulphid and polysulphid type being also involved. It was found that sulphids and polysulphids decompose rapidly after spraying, sulphuretted hydrogen being given off in gaseous form, and finely divided sulphur being deposited at the same time. This action appears to be accelerated by the presence of carbon dioxid in the atmosphere.

In addition to the sulphur the solid residue of the spray contains small quantities of the sulphate and thiosulphate salts of the particular base used and also the carbonate of the base. Thus, lime sulphur gives a deposit of sulphur mixed with calcium sulphate, thiosulphate, and carbonate, and liver of sulphur the corresponding potassium salts. Ammonium polysulphid does not give the same proportion of solid residue, owing to the volatilization of the ammonium compounds.

In regard to the toxic action of the sprays, a triple effect has been demonstrated. At the moment of application a direct toxic action sets up, due to the presence of sulphids and polysulphids as such. Their immediate action on fungi is doubtless supplemented to some extent by the sulphuretted hydrogen which at once develops.

The method of action of sulphur itself, as the chief active agent, is discussed in connection with three hypotheses which have been advanced, and with a fourth suggestion, that of the conversion of the sulphur into sulphuric acid. While sulphur is not sufficiently soluble in water to enter the cell to a toxic extent in ordinary aqueous solution, it is thought that the fluid which bathes the cell wall may possess greater solvent properties than water. It may therefore convey to the cell a toxic dose of sulphur, or this fluid, which probably contains organic matter, may act chemically on the sulphur, with the resultant formation of a toxic sulphur compound, possibly of a sulphid or polysulphid character. The third suggestion is based on the idea that matter in the form of finely divided and actively disseminated particles possesses peculiar properties of an irritant character which stimulate, to an injurious extent, cells

exposed to their action. The account of experiments made at Long Ashton is thought to show that under ordinary practical conditions none of these hypotheses meet the case.

Critical experiments recently carried out are said to have demonstrated the method by which sulphur at a distance from the plants under treatment (as in the hot water pipe method in a greenhouse) is brought into contact with the fungus. It is intended to publish shortly the details of these experiments. The case of sulphur applied at a distance is thus brought into line with that of sulphur applied directly to the plant by wet or dry spraying.

Amylase of Rhizopus tritci, with a consideration of its secretion and action, L. L. HARTER (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 761–786*).—A description is given of investigations of enzyms secreted by *R. tritici*, the work having been carried on in the Bureau of Plant Industry, U. S. Department of Agriculture. This fungus is said to secrete a vigorous starch-splitting enzym which acts on raw sweet and Irish potato starch, but more energetically on starch paste.

Dried mycelium stored at 9 to 35° C. for several months shows little deterioration as regards the enzym, but at 60° the enzym weakens gradually. The optimum temperature for starch digestion is about 45°. Hydrolysis is destroyed by maintaining a temperature of 60° for about 100 hours. Glucose retards hydrolysis, but not proportionately to the quantity added.

Temperature influences markedly the production of intercellular amylase. Results observed seem to show that there is a quantitative regulation of the enzym. The enzym powder of young mycelium just beginning to fruit was more active than the enzym from old mycelium.

A critical study of the slime molds of Ontario, M. E. CURRIE (*Roy. Canad. Inst., Trans., 12 (1920), No. 2, pp. 247–308, pls. 3*).—This paper embodies the results of critical studies of a large number of gatherings of Myxomycetes, mainly from Ontario, representing 29 genera and 117 species and varieties. Grasses or herbaceous plants are parasitized and in some cases at least injured by *Diachaea leucopoda, Diderma effusum, D. testaceum, Didymium squamulosum, Fuligo septica, Leocarpus fragilis, Mucilago spongiosa, Physarum cinereum,* and *P. sinuosum.*

Culture studies with rust fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 26 (1916), No. 5, pp. 257–277, fig. 1*).—A continuation of reports previously noted (E. S. R., 31, p. 540) deals with several rust fungi and phases thereof, also with certain hosts, and briefly with problems of overwintering in the soil.

Effect of hot-water treatment on germinability in cereals, G. LAKON (*Ztschr. Pflanzenkrank., 27 (1917), No. 1, pp. 18–25*).—The effects on germinability and growth of the fungicidal hot-water treatments are discussed in connection with data presented in tabular form.

[Complete life cycle of leaf rust determined] (*Indiana Sta. Rpt. 1920, p. 13*).—It is reported that greenhouse investigations have resulted in the discovery of the aecial stage of the leaf rust of wheat, demonstrating for the first time the complete life cycle of that rust. The investigations have also shown that various species belonging to one genus of the family Ranunculaceae are the alternate hosts for the leaf rust of wheat. Considerable progress is reported on the study of biologic forms of leaf rust, and it is claimed that two fairly distinct strains of the orange leaf rust of wheat are present in this country.

Influence of Tilletia tritici on the host, W. LANG (*Ztschr. Pflanzenkrank., 27 (1917), No. 2–3, pp. 89–99*).—It is stated that in this study a strain of wheat showed important modifications of the host plant in association with the presence of Tilletia. One of these was a severe check to growth, another an ex-

traordinary susceptibility to yellow rust. This influence proceeds not from the growing fungus, but from the excretions produced by the hyphæ. The chemical constitution of the substances involved is not known. It appears probable that it influences the composition and activity of the chlorophyll-bearing cells, and that in this way are brought about the check to growth and the sensitivity to rust.

A transmissible mosaic disease of lettuce, I. C. JAGGER (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 737–740, pl. 1*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author describes a disease of Romaine lettuce that appeared in a field at Sanford, Fla., in January, 1920. At the same time a variety of head lettuce in a neighboring field developed a similar condition, but in most cases the blotching was less marked and there was an absence of the decided mottled appearance observed in the Romaine lettuce.

The author considers the disease infectious and apparently caused by a parasite not capable of isolation through ordinary technic. The disease has been transmitted experimentally from diseased to healthy plants by means of aphids, particularly *Myzus persicae.* From the symptoms and general character of the disease, it is considered to be a true mosaic disease of lettuce.

Potato canker, E. SCHAFFNIT and G. VOSS (*Ztschr. Pflanzenkrank., 26 (1916), No. 3–4, pp. 183–192*).—Studies were carried on during 1915 in connection with the fungicidal qualities of eight disinfectants named and the resistance of a number of different potato varieties. The results are tabulated in detail. Apparently the spores of *Chrysophlyctis endobiotica* persist in the soil for seven or eight years.

Cercospora disease of potato in lower Austria, K. VON KEISSLER (*Ztschr. Pflanzenkrank., 27 (1917), No. 2–3, pp. 111–114, fig. 1*).—An account of observations on potato disease associated with *C. concors* stated that while *C. solanicola* and *C. heterosperma* were present in the leaves, each seemed to be independent and to exercise no injurious influence on the plant.

Inner splitting of potato tubers, H. ZIMMERMANN (*Ztschr. Pflanzenkrank., 26 (1916), No. 5, pp. 280–285, fig. 1*).—Observations discussed are summed up in the statement that the inner cracking (often associated with blackening) of potato tubers is due to use of one-sided nitrogenous fertilizer and with relatively small starch content in the middle of the tuber where the cracks occur.

Leaf roll, net-necrosis, and spindling sprout of the Irish potato, E. S. SCHULTZ and D. FOLSOM (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 47–80, pls. 12*).—The results are given of a cooperative investigation carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, and the Maine Experiment Station on the symptoms and means of transmission of these diseases.

The form of potato leaf roll which was a subject of this study is considered to be a nonparasitic transmissible disease which is widely distributed. The chief and perhaps the only manner of transmission from season to season is by means of tubers from diseased plants. Leaf roll usually reduces the yield considerably, and, as the disease is inheritable, it decreases the value of the tubers for seed. It is transmissible from one plant to another by means of grafting either tubers or stalks and by means of aphids. Inter-regional differences in the spread of leaf roll may depend upon differences in climate and in the abundance of aphids.

Net-necrosis is considered a leaf roll symptom, being a discoloration which results from tuber phloem-necrosis. It develops in the dormant tubers without relation to differences in storage temperature. When it occurs as a symptom

of leaf roll, the effects are prominent, one being a decided spindliness of the sprouts.

Leaf roll and mosaic are considered somewhat similar types of diseases. Roguing has proved to be much more effective in eliminating leaf roll than it has been for mosaic, at least in northeastern Maine.

Soil sterilization, C. T. GIMINGHAM and G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 37–42; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 126–132*).—An account is given of soil sterilization experiments for the control of potato wart disease, *Synchitrium endobioticum,* the results of which, within the limits here observed, do not seem very promising. The only treatment which completely killed the fungus in the soil was steam sterilization.

An account is given of the apparently spontaneous disappearance of Rhizoctonia from plats of ground on which that fungus had for several years attacked asparagus and carrots.

Nematode attack on potato, H. ZIMMERMAN (*Ztschr. Pflanzenkrank., 30 (1920), No. 4–5, pp. 139–145, figs. 4*).—An account of a study covering several years of nematodes attacking potato concludes with recommendations regarding control which include avoidance of infected ground for use with potatoes during at least three years after a known infection.

The Typhula rot of sugar beets on the Azores and its control, E. MOLZ (*Ztschr. Pflanzenkrank., 30 (1920), No. 4-5, pp. 121–139, figs. 7*).—*T. betae,* an occasional parasite in Germany, is a serious beet disease in the Azores. An account of a biological study of *T. betae* states that mycelial development is greatly favored by warmth, moisture of the air, and the presence of oxygen. This fungus utilizes sugar in the beet as a carbon source, the mycelium making slow growth on low sugar content. Light favors the formation of sclerotia, as does also increased transpiration, which is prevented by high humidity. Control measures are indicated.

Sugar cane gummosis, its cause and control, G. WILBRINK (*Arch. Suikerindus. Nederland. Indië, 28 (1920), Nos. 33, pp. 1399–1462; 34, pp. 1463–1525*).—An elaborate account is given of studies on sugar-cane gummosis, including the probable systematic relations of the causal organism. This is said to be an aerobic bacterium transmissible in diseased plant material and perhaps on the tools used in cutting up the stalks to be used in planting for the new crop.

Spraying trials, G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 43–45; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 132–134*).—The conclusions drawn from the trials here noted as continuing through one season only are that Bordeaux mixture, copper stearate, and possibly Burgundy mixture are equally effective in preventing attacks of scab on apples and pears, while a dormant spray of copper sulphate is less effective though not without value. Burgundy mixture causes serious injury to fruit and foliage.

The production of conidia in pure cultures by the brown-rot fungus of the apple, S. P. WILTSHIRE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 34–36; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 123–126*).—In this investigation of the fungicidal action of sulphur compounds the spores of the brown-rot fungus (*Sclerotinia fructigena*) were used extensively for germination tests on account of their sensitiveness to sulphur, their large size, their ready germination in water, and the plentiful supply of material available throughout the summer. An outline is given of work undertaken for the purpose of developing a method of obtaining a satisfactory supply of spores.

The apple canker fungus, S. P. WILTSHIRE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 23–29; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 113–120*).—Progress is reported as made during the year in the study of apple canker fungus, particularly as regards the culture of the apple canker organism (*Nectria ditissima*) in the laboratory and the spread of the disease under natural conditions. The germ tubes of the conidia growing under conditions of good aeration showed a negative heliotropism not so striking as in *Botrytis cinerea*, but quite definite. The exact means of infection is still under investigation. Preliminary control trials seem to show that any spraying experiments must be continued over a period sufficient to allow the full effect of the treatment to be estimated.

The relation of woolly aphis to apple canker was further studied. It appeared from experiments during 1919 that infection had taken place through the galls, especially the older galls, found toward the base of the year's growth. The fungus grew very vigorously in the gall tissue, which became very soft and disorganized, and the virulence of the disease was shown by the development of comparatively numerous pustules of conidia, even in the late autumn. It appears that infection may take place at this time through the wood elements exposed by the splitting of the aphis gall.

The die-back of red currants, S. P. WILTSHIRE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1919, pp. 30–33; also in Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 120–123*).—Sudden wilting and subsequent death of branches on red currant bushes caused considerable trouble at Long Ashton. Specimens showing similar trouble were obtained from other points, and some preliminary investigations have been made.

The first symptom of the disease was the sudden wilting of the leaves and fruit of one or more of the main branches. This wilting occurred at any time during the season, but was most noticeable in July, when the branches were laden with fruit almost ripe. Material obtained from Worcestershire, where the disease was also prevalent, showed a heavy infection by a fungus in the cortex, also in the wood. Somewhat extensive series of plate cultures resulted in the isolation of two types of fungi as the most probable agents of the disease, one of these apparently being identical with *Cytosporina ribis*. The second type of fungus produced quantities of conidia of the Fusarium type. Studies were begun with regard to *Nectria cinnabarina* in this connection.

[Localization of infection by Plasmopara (Peronospora) viticola and protection by spraying], F. MUTH (*Ztschr. Pflanzenkrank., 26 (1916), No. 8, pp. 454–467, No 1*).—An account of attempts to determine the most advantageous and economical treatments for grape downy mildew concludes with the statement that in case of neglect and consequent infection of flowers and young grapes, through drenching with 0.5 per cent Bordeaux mixture from a revolving spray will save as much of the crop as can be saved by any treatment.

Exhibition of diseases of the Para rubber tree (*Nature* [*London*], *105 (1920), No. 2629, pp. 86, 87*).—Attention is called to an important exhibition, illustrating the fungus diseases to which the Para rubber tree (*Hevea brasiliensis*) is subject in Ceylon and Malaya, which was opened on March 10, 1920, in the botany department of the Imperial College of Science and Technology. The exhibition, which was organized by J. B. Farmer of the college, included a large number of trunks of rubber trees, specially shipped from the East, showing the diseases as they occur in the plantation, and forms a striking commentary on the optimism which obtained in the first years of the industry as to the probable relative immunity of Hevea from disease.

The principal diseases represented in the collection include brown bast (bacterial?), *Fomes lignosus*, *F.* (*Poria*) *pseudoferreus*, dry rot (*Ustulina zonata*), patch canker (*Phytophthora faberi*), stripe canker (*Phytophthora* sp.), pink disease (*Corticium salmonicolor*), thread blight (*Cyphella heveae*), and die-back (*Botryodiplodia theobromae*).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Instructions for bird banding, F. C. Lincoln (*U. S. Dept. Agr., Dept. Circ. 170 (1921), pp. 19, figs. 12*).—In 1920 the work conducted by the American Bird Banding Association, organized in December, 1909, in continuation of several local attempts, was taken over by the Bureau of Biological Survey. In view of the valuable information to be secured relative to the movements and life histories of migratory birds, especially the game and insectivorous species, it is the plan of the bureau to advance this method of research along two principal lines: (1) The banding of fledglings as formerly practiced, and (2) the systematic trapping and banding of adults. The present circular gives directions for carrying on the work, including plans for the construction of traps, directions for their operation, methods of handling, attaching bands to birds, etc. The problems that can be solved by bird banding are summarized.

Twentieth report of the State entomologist for 1920, W. E. Britton (*Connecticut State Sta. Bul., 226 (1921), pp. 135–216, pls. 12, fig. 43*).—The inspection of imported nursery stock and of apiaries, first reported upon, is followed by a detailed Report of Work in Suppressing Gipsy and Brown-tail Moths, by W. E. Britton, I. W. Davis, and J. T. Ashworth (pp. 151–168), which includes a review of the status of the gipsy moth parasites and predators in the State. No new towns were found infested with the gipsy moth, and no trace of it was found in seven of the towns that were infested a few years ago.

Experiments in Dusting in Comparison with Spraying to Control Apple Insects (pp. 168–177) indicate that it is possible to hold the chewing insects in fairly satisfactory control by the use of the dust treatment. "With the addition of nicotin solution some of the sucking insects, particularly false red bug, seem to have been checked, but the data are too meager upon which to base conclusions. The nicotin makes the dusting mixture very much more expensive. The chief advantage of dusting over spraying is in the saving of time and labor. The disadvantage is in the cost of the materials, and apparently this more than offsets the saving in time and labor, as the approximate cost of one treatment per tree was fully three times as great for dusting as for spraying. If varieties are grown which are not susceptible to scab, and if sucking insects are not troublesome, dusting may give good results, but if these pests are serious in the orchard, better control will probably be obtained by spraying—a method which has been in common practice long enough so that we know its possibilities."

Notes on the Life History of the False Apple Red Bug in Connecticut, *Lygidea mendax* Reu. (pp. 177–179); Notes on the Life History of a Sawfly Feeding on Austrian Pine, *Itycorsia zappei* Roh. (pp. 179–182); and Tests of Soap Sprays to Kill the Pink and Green Potato Aphid, *Macrosiphum solanifolii* Ashm. (pp. 182, 183), all by M. P. Zappe, are next presented. In tests of soap sprays on the green potato aphid a soft soap intended for use in washing automobiles, made with a linseed oil base and containing only 56.2 per cent water, was employed. This soap, which cost 25 cts. per pound wholesale in 24 lb. pails, when used at the rate of 0.5 oz. to 1 gal. of water, was 100 per cent effective in killing the aphids on dipped potato plants. Part of a field of

potatoes was also sprayed with it with very good results. Two other brands of soap used were less effective.

The European Red Mite, A New Orchard Pest in Connecticut, *Paratetranychus pilosus* Can. and Fanz., is next reported upon by P. Garman (pp. 184–189). Observations indicate that this mite has been in Connecticut at least three years, having been found at Greenwich, Danbury, Milford, Branford, Wallingford, Middletown, and Meriden. It has also been reported from Ontario and Pennsylvania, and is thought to occur in New Jersey. This mite passes the winter in the egg stage on twigs, in crevices in the bark, etc., in the orchard, and is a source of injury to the leaves. Injury was seen on Baldwin, Ben Davis, McIntosh, and Hurlburt, but in nearly every case the Baldwin showed the effects of infestation more than other varieties. Tests of various insecticides are reported upon in tabular form. Orchard experiments showed that attention must be given to early sprays, especially the delayed dormant application. This spray, apparently, should not be diluted more than 1:9, in the case of lime sulphur, and should be applied with great care to cover as much of the tree as possible.

The Apple and Thorn Skeletonizer in Connecticut, *Hemerophila pariana* Cler. (pp. 190–193), which pest has recently become established in the United States (E. S. R., 38, p. 60), was discovered in the fall of 1920 to occur in the towns of Greenwich and Stamford. The Sinuate Pear-tree Borer (pp. 193–196) is a source of considerable injury in pear orchards in Stamford and Greenwich, the Bartlett seeming to be the preferred variety. Brief summarized accounts are also given of The European Corn Borer (pp. 196–198); The Pear and Cherry Slug, *Caliroa cerasi* L. (pp. 199–201); The Currant Stem Girdler, *Janus integer* Nor. (pp. 201–204); The Celery Caterpillar or Fennel Worm, *Papilio polyxenes* Fab. (pp. 204–206); and The Grape Berry Moth (pp. 206, 207). An account is given of Mosquito Work, Season of 1920, by S. T. Sealy (pp. 208–210), and the report concludes with Miscellaneous Insect Notes (pp. 210–215).

[**Report of the department of**] **entomology** (*Indiana Sta. Rpt. 1920, pp. 22, 23, figs. 2*).—Investigations are said to have led to the conclusion that there are no well-defined broods of the codling moth in the State, but that from the time of emergence of the first moths, the first week in May, there is practically no break to the first of September following, the latter date depending upon the weather conditions. It is pointed out that this will necessitate the revision of spray schedules, and that the spraying schedule must be effective and thorough from the beginning to the end of the season in order to give satisfactory control.

During the year an unusual poultry mite, *Lyponyssus silviarum*, made its appearance in one of the houses of the poultry department, which led to tests of 40 different combinations of materials for its control. Dusting with sulphur proved quite satisfactory. In fumigation experiments it was found that nitrobenzol could be successfully used for killing the mites without injuring the fowls, but with the egg-laying hens the fumes inhaled affected the unlaid eggs to such an extent that they could not be used for domestic purposes.

Report of the entomologist, C. E. Wilson (*Virgin Islands Sta. Rpt. 1920, pp. 20–34*).—During the year 1920 a careful study was made of scale insects and their host plants in the Virgin Islands. This is reported in tabular form, the scientific name, common name, host plants, and occurrence on each of the three main islands being given for each species, of which 46 are recorded.

An improved insecticide emulsion, which will keep indefinitely in the concentrated form without separation of kerosene and which will also keep in the

form of emulsion for a long period when diluted, first described by the agronomist in his report for 1915 (E. S. R., 36, p. 252), was used with success in the control of Coccidae and other insects. It is made by dissolving 4.5 lbs. of whale-oil soap in 1,000 cc. of fusel oil, to which 8,000 cc. of kerosene is added and the whole vigorously stirred until thoroughly emulsified. The stock solution may be diluted at the rate of 1 to from 10 to 20 parts of water.

The widespread and constant increase in numbers of *Aleurodicus cocois* and *Aleurothrixus floccossus* led to the introduction of the red fungus (*Aschersonia aleyrodis*) as a control measure. Due to unfavorable conditions at the time, this fungus failed to become established.

Investigations of sugar-cane insects have shown infestation by the sugar-cane borer (*Diatraea saccharalis*), the weevil cane borer (*Metamasius sericeus*), the cerambycid cane borer (*Lagochirus araneiformis*), mealy bugs (*Pseudococcus sacchari* and *P. calceolariae*), scale insects (*Targionia sacchari*), root grubs (*Ligyrus* sp. and *Strataegus titanus*), and shot-hole borer (*Xyleborus* sp). The borers *M. sericeus* and *L. araneiformis* caused the most injury, 15 per cent of the cane on the station grounds being damaged by them during the year. It is estimated that their ravages resulted in the loss of more than 2,000,000 lbs. of sugar during the year.

Cotton was found to be attacked by the cotton aphis, cotton worm, bollworm, green stink bug (*Nezara viridula*), the cotton stainer (*Dysdercus andreae*), the leaf blister mite (*Eriophyes gossypii*), the West Indian peach scale (*Aulacaspis pentagona*), the hemispherical scale, and the black scale.

Corn and Hopi maize suffered severely from insects during the year. Young corn plants in St. Croix were severely damaged by the corn leafhopper (*Dicranotropis maidis*), while very few were found on the Hopi maize. Other insects mentioned are the bollworm, which injured Hopi maize even more than corn; the sugar cane borer, which attacked both; and the corn aphis (*Aphis maidis*), which occasionally appeared on young corn and was largely kept in control by parasitic and predacious insects.

The West Indian sweet-potato weevil (*Euscepes batatae*) is the most serious enemy of sweet potatoes in the Virgin Islands. Its injury, which was 90 per cent on untreated vines, was reduced about 75 per cent by dipping in kerosene-fusel oil emulsion, as mentioned above. Its injury to late-planted vines was reduced about 60 or 65 per cent, untreated check vines having shown about 98 per cent infestation.

Two species of white flies were noted, namely, *Aleurodicus cocois*, which was found attacking the leaves of almond, banana, calabash, coconut palm and other palms, and *Ficus elastica*, and *Aleurothrixus floccossus*, which was found attacking guava.

Notes on the occurrence of and means of control for a number of other insects of importance during the year are also presented. The pests thus noted include the cattle tick, which was found every month on cattle; the fig borer (*Batocera rubus*), which did severe damage to fig and mango trees; mosquitoes, of which *Aedes calopus*, *Anopheles albimanus*, and *Culex quinquefasciatus* were the only species collected in St. Croix; *Corythuca gossypii* and the West Indian white peach scale (*Aulacaspis pentagona*), found infesting castor beans; slugs (*Veronicella occidentalis*), reported as doing severe damage to all vegetables in St. Thomas; the green stink bug, which in some cases rendered 50 per cent of the green pods of beans unfit for use; the bean leafroller; the southern beet webworm (*Pachyzancla bipunctalis*); the diamond-back moth; the southern cabbage butterfly (*Pontia monuste*); the cabbage aphis; the melon caterpillar; and a number of other pests found injuring eggplants, okra, tomatoes, and stored grain and grain products.

Effects of nicotin sulphate as an ovicide and larvicide on the codling moth and three other insects, N. E. McIndoo, F. L. Simanton, H. K. Plank, and R. J. Fiske (*U. S. Dept. Agr. Bul 938 (1921), pp. 19*).—This bulletin is based upon experiments conducted in the laboratory at Washington and in three important apple regions of the United States, namely, the Lake region at Benton Harbor, Mich., the mountainous region at Grand Junction, Colo.; and the semiarid region at Roswell, N. Mex. The first part of the report consists of experiments conducted in the laboratory concerning the effects of nicotin sulphate as an ovicide and larvicide on the codling moth, silkworms, Colorado potato beetle, and the white-marked tussock moth (pp. 2–15). This is followed by experiments conducted with a view to determining the effectiveness of nicotin sulphate as compared with the efficiency of arsenate of lead for controlling the codling moth in orchards.

In the laboratory nicotin sulphate, with one exception, was found inefficient against all of the eggs tested. "About 20 per cent of the freshly laid eggs sprayed with a solution of nicotin sulphate 1:800 failed to hatch and one-third of the remaining embryos that emerged died before they entered pears sprayed a week previously. Hence about one-half of the eggs and larvae had been destroyed up to the time when the remaining larvae entered the sprayed pears; a large percentage of the latter larvae died, as about 60 per cent of the pears did not become wormy. According to these laboratory results, nicotin sulphate does not seem to be efficient against the codling moth, although only one application of it was made; nevertheless its effectiveness would certainly be increased in proportion to the number of its applications and to the amount of rainfall."

The conclusions drawn from field experiments are as follows: "According to the work conducted during the season of 1917, it is shown that nicotin sulphate 1:800 with soap gave a fair degree of control for the codling moth at Benton Harbor, Mich., and at Roswell, N. Mex., but that it was not as effective as 1 lb. of powdered arsenate of lead to 50 gal. of water; and also that there was no practical advantage in combining arsenate of lead and nicotin sulphate in sprays designed to control the codling moth. Of course, it is well known that nicotin sulphate controls aphids on fruit trees, but this phase of the subject is not considered in this paper. At Grand Junction, Colo., where the infestation was much heavier, nicotin sulphate 1:800 without soap was inefficient against the codling moth."

Experiments with grasshopper baits, J. R. Parker and H. L. Seamans (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 138–141*).—This is a brief report of preliminary experiments conducted in Montana during the summer of 1919 for the purpose of improving the efficiency and reducing the cost of the poison bran mash commonly used for grasshoppers, special attention being given to finding substitutes for lemons and oranges. A brief reference to this work is made by Cooley in a report previously noted (E. S. R., 44, p. 348).

Amyl acetate was found to be not only the most attractive of the materials tested but also the cheapest of those that ranked high in attractiveness, an ounce, costing 5 cts., being equal to 8 lemons or oranges. Vanilla ranked second in the list of attractive materials and with amyl acetate was far better than any of the other materials tried, although its present cost prevents its use. Of the fresh fruits, watermelon gave the best results, but it was not nearly as attractive as amyl acetate or vanilla and but little better than salt alone. Salt alone was found to give as good results as molasses and salt, and both gave better results than when lemons or oranges were added. Oranges ranked fifth in the list of 12 attractive elements used, and lemons ranked tenth in order.

It is pointed out that these tests were conducted with adults of only one species, namely, *Camnula pellucida* Scudd., which had gathered in great numbers for breeding and egg laying.

Chinch-bug resistance shown by certain varieties of corn, W. P. FLINT (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 83–85*).—In comparative tests in counties in Illinois heavily infested with chinch bugs, where a number of varieties of corn had been used, that known as White Democrat was markedly resistant when grown on fertile soil. The higher yield in this and several other varieties seems to be entirely due to their power to resist chinch-bug attack, since there was no difference in the number of chinch bugs present.

The potato leafhopper and tarnished plant bug in 1916, S. MARCOVITCH (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 61, 62, pl. 1*).—This is a report upon observations made in Minnesota.

Further notes on the life history of the potato leafhopper (Empoasca mali Le B.), A. HARTZELL (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 62–68, fig. 1*).—This is a report of studies of the life history of *E. mali* made at the Iowa Experiment Station during the season of 1920, in continuation of those previously noted (E. S. R., 44, p. 549).

The influence of leafhopper control on potato yields, J. R. EYER (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 69–71*).—The author reports briefly upon comparative tests of different insecticide and fungicide combinations, made during 1919 and 1920, which lead him to question the economy of attempting the control of hopper burn in regions where there is comparatively little sunshine during the growing season.

Progress report on the season's work on the production of potato tipburn, F. A. FENTON (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 71–83, figs. 2*).—Tests were conducted during 1920 to determine the effect of artificial mutilation on the potato leaf, the result of colonizing leafhoppers (*Empoasca mali* LeB.) on the plant foliage under different environmental conditions, the comparative effect of different stages of the insect on the leaves, the injury other insects might produce, and the effect of Bordeaux mixture on the leafhoppers.

"Tipburn or hopperburn of the potato is produced through the agency of *E. mali*. All nymphal stages of the leafhopper are capable of producing symptoms of the disease. The older the nymphs the greater the amount of injury done, nymphs in the first and second instars being incapable of producing any effect on the leaf unless in numbers. The greater the number of nymphs on a leaf the sooner the injury develops and the more rapidly the leaf or plant is killed. The adult hopper is not nearly so effective as any of the nymphal stages but will produce the disease when concentrated in large numbers on a given plant.

"The disease is produced to the same extent and just as soon under such diverse environmental conditions as type of soil, amount of moisture in the soil, presence or absence of sunlight, or reduced leaf transpiration. Tipburn as a disease is localized, being confined to that part of the plant exposed to the attack of the leafhoppers, whether this be a leaflet or entire branch.

"Other insects known to feed on potato, such as Buffalo treehopper nymphs, tarnished plant bugs, potato aphis, and flea beetles, produce a type of injury characteristic of the individual species concerned but in no way resembling tipburn.

"Bordeaux mixture prevents tipburn by repelling the ovipositing female leafhoppers."

The corn leaf aphis (Aphis maidis Fitch) in Kansas, J. W. MCCOLLOCH (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 89–94, pls. 2*).—This is a report of observations made at the Kansas Experiment Station of the more important types of

injury, and of certain experiments which indicate possible means for the reduction of the injury. The author finds that in Kansas *A. maidis* is a pest of the various sorghum crops, as well as of corn.

The satin moth, an introduced enemy of poplars and willows, A. F. Burgess (*U. S. Dept. Agr., Dept. Circ. 167 (1921), pp. 16, figs. 7*).—The satin moth (*Stilpnotia salicis* L.), a well-known European pest, was first reported from the United States about July 1, 1920, as defoliating Carolina poplars (E. S. R., 44, p. 252). A survey made of the infestations show an area of 642 square miles, including 60 towns in Massachusetts and 4 in New Hampshire, to have been infested by it during 1920. The pest is thought to have been in this country for several years but only became abundant enough to spread very rapidly during the past two or three years, the worst infestation being in the area along the Fellsway at the Medford-Malden, Mass., line.

Its name is taken from the white, satin-like appearance of the moths, which are larger than most of the white moths native to New England and have no colored markings on the wings. The eggs are laid in somewhat elongated patches, 13 to 22 mm. in length, and covered with a white secretion which holds them together in the cluster, which is very conspicuous and easily distinguished from the egg masses of other moths. Dissections show that a female produces about 550 eggs, which are usually laid on the underside of the leaves and on the branches and trunks of the trees, though they are sometimes deposited on grass, weeds, or stones, and even on the ground if no more convenient place is available. In 1920 the first eggs were observed in the field July 6, and an unhatched cluster was found as late as August 10. Hatching takes place about 15 days after oviposition, though the period is frequently shorter if the weather is hot.

In the first two larval stages molting takes place after 5 or 6 days. Arriving at the third stage the larvae immediately seek shelter and begin the construction of a small web, in which they hibernate. Crevices or uneven places in the bark are sought by the larvae, and if the cavity is not sufficiently deep a small amount of bark is excavated. The cavity is then lined with silk, and the larva spins a cover over the entrance. While probably most of the larvae remain in the pockets during the winter, a few cases have been noted where they have deserted them temporarily during the fall.

The feeding of the small caterpillars is confined to the epidermis of both sides of the leaves, and if the infestation is severe, most of the foliage on the trees may be denuded so that only the ribs and framework remain. Since most of this feeding occurs during the first half of August, many of the leaves that are only partially eaten turn brown and drop earlier than normal. "Observations in the field during 1920 indicated that feeding by the small larvæ was confined principally to different species of poplar, the Carolina, Lombardy, Balm of Gilead, and silver leaf showing the most defoliation. In the laboratory experiments willow was equally favored, but the small larvae starved rather than feed on alder, apple, gray birch, elm, red oak, and white oak."

Emergence in the spring has not been observed in this country, but the larvae probably come out of the webs and begin feeding as soon as sufficient foliage is available. After passing through several molts they become full grown by about July 1. When full grown the larvae are 45 to 50 mm. long, with a bluish-black head covered with short hairs and a black body mottled with white markings of irregular shape. After feeding is completed the larvae seek shelter and spin loose cocoons, many of which are made by drawing together the edges of leaves on the trees. They are sometimes made in crevices in the bark, in rubbish near the base of trees, or on the sides of buildings. Pupation in 1920 was at the maximum by July 6, the time spent in the pupal stage

averaging 9 days. The first moth was found on July 2, and for the next two weeks the number increased.

The species is common in England and Ireland, and throughout Europe, its range extending from Spain to Eastern Asia and as far north as Norway, and it is said to be present in the Orient.

In Europe it is usually controlled by parasites and other natural enemies and is not considered a pest of first rank. Of the numerous parasites which attack it, a number are already well established in the infested area in New England. Field observations show *Calosoma sycophanta* L. to be one of the valuable insects that attack the larvae and pupae, and *Compsilura concinnata* Meig. was found to heavily parasitize the large larvae. *Telenomus californicus* Ashm. has been reared from the eggs. Control measures consist in the application of creosote to the egg clusters and in the use of arsenate of lead in the spring, as soon as the trees are in full leaf, at the rate of 10 lbs. to 100 gals. of water, using soft soap for a sticker, to be repeated in the middle of June and again about August 1 if necessary.

The pea moth in Wisconsin, C. L. FLUKE, JR. (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 94–98*).—This is a summary of studies of *Laspeyresia novimundi* Heinr. conducted by the author, a bulletin on which has been noted (E. S. R., 43, p. 257).

European corn borer in New York State, E. P. FELT (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 85–89*).—This is a brief account of the status of this pest in New York.

Biology of the smartweed borer, Pyrausta ainsliei Heinr., G. G. AINSLIE and W. B. CARTWRIGHT (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 837–844*).—This is a report of observations of *P. ainsliei*, which first came to the attention of the senior author in 1912, when hibernating larvae were found in cornstalks at Franklin, Tenn. It is pointed out that until recently the species, which was first described by Heinrich in 1919 (E. S. R., 42, p. 361), has been confused with a similar species, *P. penitalis* Grote, which feeds on lotus. A summary of information on smartweed and lotus borers by Chittenden, in 1918, has been noted (E. S. R., 40, p. 756).

The smartweed borer is known to occur in Massachusetts, New York, Pennsylvania, Ohio, and Illinois, and has been taken by the author at numerous points in Tennessee and Kentucky, and at Clemson College, S. C. Since its principal food plant, *Polygonum pennsylvanicum*, occurs throughout the eastern half of the United States, it is thought likely that the distribution of the borer is coextensive with it.

It is pointed out that the plants on which larvae are found include food plants proper and also shelter plants. While several species of the genus Polygonum have been recorded as food plants of the larvae, the authors' observations indicate very clearly that south of the Ohio River, at least, it breeds only in *P. pennsylvanicum*. The species has been reared from eggs to full-size caterpillars on leaves of curled dock (*Rumex crispus*) and buckwheat (*Fagopyrum fagopyrum*), both of which are close relatives of Polygonum, but the larvae have never been found on these plants in the field. On the leaves of lotus (*Nelumbo lutea*), which is the host plant of *P. penitalis*, the larvae in several experiments have starved to death after merely pitting the leaf surface, and the statement of Heinrich (E. S. R., 42, p. 361) that the authors have reared larvae to maturity on *N. lutea* is said to be an error. Shelter plants include all plants the stems of which are entered by larvae seeking winter quarters, of which a number, including corn, are recorded.

"In Tennessee there are two generations of the smartweed borer each year. Adults reared at Knoxville emerged from May 26 to October 30 with two

ell-defined periods of maximum abundance, the first from June 20 to July 5 nd the second from August 18 to 30. Moths emerging in June at once oviposit, nd the resulting larvae complete their growth early in August and immediately upate in their larval burrows in the smartweed stems. The moths emerge ater in the same month and give rise to the second generation of larvae, hich reach full growth before winter and without further feeding remain n the food or shelter plants unchanged until they pupate in May and June f the following year."

In a reared series of larvae from eggs hatching August 16 a number of moths merged October 13 and 15. The eggs have been taken many times by the uthors in the field, but oviposition has not been observed. They are laid in nall patches or often in rows, with the individual eggs overlapping shingle ashion, on the underside of the leaves. The number of eggs per mass varied rom 4 to 16, with an average of 9.3, in a collection of 30 egg masses and from to 14, with an average of 9.47 per mass, in a collection of 17 egg masses. The ncubation period from June to July was 6 days and in late August 5 days.

Upon hatching, the young larvae at once enter the stem near the tip of a anch, choosing the base of a petiole for their point of attack. That they are mewhat gregarious at this stage is shown by the fact that all the larvae atching from one egg mass usually enter the stem at the same point, which ay be several inches from the egg mass. Larvae of the first generation make o effort to leave the smartweed stems but pupate in them as soon as fully d. Those of the second generation attack the plants in the same way and ed as did their progenitors until they are fully grown. This stage is reached bout the last of August, and thereupon many of the larvae abandon their st plant and seek shelter elsewhere.

The species varies greatly in abundance from year to year. This in Tenssee, at least, appears to be due to the variation in the abundance of its rasites, of which the most important is the tachinid (*Panzeria*) *Pyrausmvia penitalis* Coq. Over 40 per cent of the larvae taken in the field at noxville for rearing are said to have been killed by this parasite. The flies at have been reared by the authors have emerged during two distinct periods, om May 30 to June 10 and from August 18 to September 12, coinciding closely ith the normal dates for the emergence of the adults. This is thought to dicate that the flies attack the host larvae during their early instars. Three her tachinid flies are said to have been reared from *P. penitalis*, namely, *corista vulgaris* Fall., *Hypostena variabilis* Coq., and *Phorocera comstocki* ill., and three apparently distinct hymenopterous parasites, by the authors.

Report on investigations of the pink bollworm of cotton in Mexico, U. C. FTIN, K. B. McKINNEY, and W. K. HANSON (*U. S. Dept. Agr. Bul. 918 (1921), . 64, pls. 5, figs. 11*).—The present report is based upon two years' work conucted in Ciudad Lerdo, Durango, Mexico, near Torreon, the so-called Laguna strict, by the Federal Horticultural Board. The report deals with the disbution of the pink bollworm (*Pectinophora gossypiella* Saund.), its life hisry, seasonal history, feeding habits of the larvae, damage caused, food plants, spersal, natural control, and repression.

This pest was introduced into Mexico in 1911 with seed for planting, and five ars later was generally and uniformly distributed throughout the Laguna d had reached its maximum development. Infestation starts in the spring soon as squares are formed, by moths emerging from hibernating larvae, d rapidly increases until practically every boll is infested with several larvae fall. Its life cycle was found to be completed in an average of 31 days in

the summer, but the larval stage of hibernating or resting larvae may be extended for two years or more.

"Dispersal is mainly through the carriage by man of hibernating larvae in seed, but local dispersion is brought about also by flight and carriage of adults. The pink bollworm causes approximately 25 per cent gross damage to the Laguna crop by feeding in the bolls and squares. This feeding results in a reduction in the quantity and quality of the lint produced, reduction in the quantity of seed, and lowering of the quantity and quality of the oil content of the seed. Early cleaning of fields by burning all the old stalks and bolls, cleaning and fumigation of gins, oil mills, and seed warehouses, the fumigation of all seed kept on the plantations, and the early maturity of the crop are recommended as means of control."

A list is given of 12 references to the literature cited, and a description of the pink bollworm, by Busck, in a paper previously noted (E. S. R., 37, p. 564) is reprinted in an appendix. An account of this pest by Hunter has been noted (E. S. R., 39, p. 764).

Some Lepidoptera likely to be confused with the pink bollworm, C. HEINRICH (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 11, pp. 807–836, pls. 17*).—This is a report of studies conducted for the purpose of defining the characters by which the larva and pupa of the pink bollworm (*Pectinophora gossypiella* Saund.) can be distinguished from those of other Lepidoptera attacking cotton or related malvaceous plants and from those feeding on plants other than malvaceous but frequently found in the neighborhood of cotton fields.

It is pointed out that a few species, including *Dicymolomia julianalis* Wlk. and *Crocidosema plebeiana* Zel., so closely resemble the pink bollworm in their habits and their larval stages that they can only be distinguished by a careful examination of their structure. The field work upon which this paper is based was conducted throughout the area in southeastern Texas where the pink bollworm has been found to occur, and in Cameron County at the southern extremity of the State. In the present paper 38 species are considered, of which six, namely, *Gelechia neotrophella*, *Telphusa mariona*, *Borkhausenia diveni*, *Holcocera confamulella*, *Eucosma discretivana*, and *Phalonia cephalanthana* are described as new, and four, previously described, are recorded from the United States for the first time.

Experiments with contact sprays for leaf miners, W. C. O'KANE and C. A. WEIGEL (*New Hampshire Sta. Tech. Bul. 17* (*1921*), *pp. 24, figs. 5*).—The experiments here reported were commenced in the laboratories at Durham, N. H., in the early summer of 1917 and were continued in near-by orchards, with additional studies at Columbus, Ohio. The work was carried on with apple foliage infested with the apple leaf trumpet miner, with foliage of marguerites infested with the marguerite fly (*Phytomyza chrysanthemi*), and with quince leaves infested by miners. The results of the studies have been summarized as follows:

"Preliminary laboratory experiments gave inconclusive results as to penetration of sprays into leaf mines in the species observed, except adjacent to points where there was an opening to the surface.

"Studies of the apple leaf trumpet miner under orchard conditions gave the following results: The expectation of normal position of the larva in the mine from 2,645 observations was for mature larvae, first generation, 10+ per cent at small end of mine, 71+ per cent at center, 18+ per cent at large end; for young larvae, second generation, 53+ per cent at small end, 30+ per cent at center, 16+ per cent at large end. The expectation of normal dead was for mature larvae, first generation, 6.79 per cent; for young larvae, second generation, 7.01 per cent. The position of dead larvae from all treatments corre-

sponded approximately to the position of normal larvae. Records of larvae from sprayed foliage, tabulated according to size of larva, showed maximum mortality of 41 per cent in smallest larvae, this mortality diminishing steadily to a minimum of 13 per cent in larvae of next to largest size. No casual relationship was discovered between position of larva in mine and mortality. The more mature larvae were found more frequently in the smaller end of the mine, and the younger larvae were found more frequently in the larger end of the mine. A study of progressive mortality following spraying showed an apparently considerable mortality at the end of 24 hours, a diminished mortality at the end of 48 and 72 hours, and a marked increased mortality at the end of 7 days. None of the sprays used gave any considerable efficiency with mature larvae of the apple leaf trumpet miner, first generation; nicotin sprays at the stronger dilutions and, to a less extent, kerosene emulsion 1:8 gave net efficiency ranging from 73 to 37 per cent with the young larvae, second generation.

"Experiments with the same materials on quince leaf miner (omitting kerosene emulsion) gave a mortality ranging from 14 to 100 per cent, the heavier mortalities predominating. Experiments with highly concentrated insecticides on mines containing pupating larvae and pupae of the apple leaf trumpet miner gave a maximum mortality of 83 per cent, but in most cases a mortality of less than 50 per cent. Contact sprays applied to foliage bearing eggs of the apple leaf trumpet miner gave mortalities ranging from 89 to 100 per cent in the case of all nicotin sprays and in the case of lime sulphur solution. Kerosene emulsion gave a maximum mortality of 7+ per cent. Sprays applied for the first generation of the apple leaf trumpet miner gave definite residual effects on the eggs of the second generation, laid two to three weeks later, the mortality on foliage that had been sprayed with nicotin sprays at the less dilutions ranging from 70 to 90 per cent, as compared with a normal mortality of 22 per cent. Lime sulphur and kerosene emulsion gave no apparent residual effects. Chemical tests intended to detect the presence of sprays eight days after application in somewhat rainy weather gave negative results. Further tests under somewhat different weather conditions gave positive reactions at the end of 5 days, occasional reactions at the end of 8 days, and rarely at the end of 11 days."

Hessian fly prevention, H. A. Gossard and T. H. Parks (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 53–60*).—This is a discussion of work in Ohio during the years 1919 and 1920, which has led to the following conclusions:

"A well-organized extension service cooperating with the county farm bureaus can get the recommended dates for seeding into the hands of the farmers within 24 hours or less after they are determined from the emergence records. And, further, by energetic preliminary work, the extension entomologist can secure the ready cooperation of 99 per cent of the farmers in a seeding campaign. . . . As a result of our annual surveys and correlated efforts, a threatened heavy brood of fly has been kept suppressed, and there will be twice as many bushels of wheat in Ohio in 1921 as would have been the case had we given the insect no attention."

The beet leaf-beetle and its control, F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 1193 (1921), pp. 8, figs. 7*).—This is a summary of information on *Monoxia puncticollis* Say, the larva and, to a lesser extent, the adult of which, in the Rocky Mountain States, injure the foliage, especially of young sugar beets, and also attack table beets of all kinds and spinach. The present paper gives more detailed information than the earlier account (E. S. R., 15, p. 692).

This species occurs along the Atlantic seaboard from Massachusetts to Florida, in California near the seacoast, and in the alkaline regions of Colorado, Utah, New Mexico, Arizona, Idaho, and Montana, as well as in portions

of Kansas and Texas. The maritime forms occurring along the Atlantic and Pacific coasts do not cause injury and may be distinct geographical races. The adults feed on sugar beets, garden or table beets, mangel-wurzel, Swiss chard, spinach, lamb's-quarters, seablite, Russian thistle, saltwort, saltbush, sea-purslane, and pigweed. The larvae feed on sea-blite, lamb's-quarters, Russian thistle, and sugar beets only. The adults cut large, irregular holes through the leaves of the sugar beet, and the larvae do similar injury, eating pits in the leaves, frequently without cutting through. They also act as carriers of the spores of beet leaf-spot.

In the Arkansas Valley in Colorado there are two generations and a partial third each year. The beetles pass the winter on the surface of the ground in alkali areas under tufts of grass, etc. They issue from winter quarters in March and April and deposit their eggs. The first generation of beetles from these eggs, in Colorado, appears late in May or early in June, and the second generation becomes mature during the latter part of July. The eggs hatch in from 8 to 18 days, the larvæ feeding from 3 to 4 weeks. When mature, the larvæ burrow into the soil to a distance of 0.5 to 2 in. and form cells in which, in 8 or 9 days, they transform to pupae and then to adults.

Control measures consist in burning the grass, weeds, etc., in which they hibernate, and their control is furthered by use of trap heaps of weeds, etc., which are later burned. In tests made with arsenicals and other insecticides neither dusting nor spraying has proved entirely effective.

The Mexican bean beetle, a new pest in Alabama, W. E. Hinds (*Alabama Col. Sta. Bul. 216 (1921), pp. 11–18, pls. 4, fig. 1*).—This is a popular summary of information on *Epilachna corrupta* Muls., which is thought to have been introduced into Alabama in carload shipments of alfalfa hay, and by November, 1920, had spread into all or parts of 13 counties centering around Birmingham, Ala., the known infestation at that date covering at least 4,500 square miles. Earlier accounts, by the author, of its occurrence in Alabama have been noted (E. S. R., 45, p. 55).

In Alabama it attacks all varieties of table beans, including all of the kidney beans, whether of the common snap or shell varieties, cornfield beans, California black-eyed peas and all other cowpeas, and soy beans. In the experience of Alabama bean growers the destruction of kidney bean crops (snap and shell beans) has commonly been complete after about the first of July, while only a part of the early spring crop has been secured and the late planting of beans has proved useless. Lima beans are usually less completely destroyed, and a partial crop may be secured. Pole and "cornfield" beans have been completely destroyed as a rule. It is thought the loss in the table bean crops may exceed 70 per cent. Crops of cowpeas and soy beans, while usually less severely injured thus far, have in some cases been riddled about as completely as the table beans, the reduction in the yield of cowpea hay having been as high as one-third of its normal weight and the loss in feeding value an even greater proportion. The winter is passed only in the adult stage, most of the beetles continuing to feed until frost has killed the foliage.

Quarantine measures have been applied to the known infested area and to an adjoining safety zone approximating 25 miles in width. No really effective and satisfactory measures of control are yet known. It is thought that the most effective methods of checking the bean beetle consist in the prevention of late fall breeding and the removal of favorable winter shelter. Control by application of arsenical poison to the foliage is not satisfactory (1) since the insects are mainly repelled instead of killed, (2) because of the difficulty of applying any insecticide so as to coat the undersurface of each leaf and reach their feeding places, (3) because of the rapid growth of the young bean plants

before the injury becomes great, thus quickly providing fresh unpoisoned food areas, and (4) bean foliage is extremely tender and liable to burning by a treatment that might kill the insect.

Studies of this pest by Merrill, in New Mexico (E. S. R., 37, 465), and a bulletin by Chittenden and Marsh (E. S. R., 43, p. 455) have been noted.

A girdler on artichoke and other little-known insect pests, W. J. Baerg (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 99, 100*).—The cerambycid *Mecas inornata* Say is said to girdle the main stem of the artichoke, in Arkansas, about 6 in. from the top at the time of oviposition. Caterpillars of *Haploa colona reversa* Stretch are said to have appeared on strawberries early in April in the neighborhood of Johnsons, Ark., about 10 per cent of the foliage being destroyed. *Elcodes tricostata* Say is said to have damaged strawberry plants in new beds.

[Papers on apiculture] (*Jour. Econ. Ent., 14 (1921), No. 1, pp. 101–137*).—The papers here presented, which were given at the meeting of the section on apiculture of the American Association of Economic Entomologists held at Chicago in 1920, are as follows: The Value of Good Queens, by F. B. Paddock (pp. 101–105); the Problem of Controlled Fertilization of Queen Bees, by L. V. France (pp. 105–110); Further Notes on the Value of Winter Protection for Bees, by J. H. Merrill (pp. 110–114); Some Beekeeping Problems for Experiment Stations, by F. C. Pellett (pp. 114–116); Stopping the Distribution of American Foul Brood at its Source, by S. B. Fracker (pp. 117–121); Legislation for Control of Foulbrood, by M. C. Tanquary (pp. 121–127); and Mixed Infection in the Brood Diseases of Bees, by A. P. Sturtevant (pp. 127–134).

Leconte's sawfly, an enemy of young pines, W. Middleton (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 741–760, pls. 5, figs. 3*).—This paper summarizes the status of knowledge of the life and seasonal history of *Neodiprion lecontei* (Fitch), a sawfly originally described from specimens collected in New York, which occurs from southern New England south to Virginia and West Virginia and west to Michigan and northern Wisconsin, and has been collected in North Carolina and in southern Mississippi and Louisiana.

The first part of the paper consists of detailed descriptions of the life stages. The time between the deposition of the first egg and the emergence of the last adult is said to be approximately either 12 or 14 months, that is, 12 months when the eggs are laid in the late summer or early fall and 14 months when they are laid in the later spring or early summer. From the cocoons of a single colony there are two periods of adult emergence, the first of which is termed "brood A" and the second "brood B." When the colony period begins in late spring or early summer, brood A emerges in the late summer and early fall of the same year and brood B emerges in the late summer and early fall of the following year, making the length of the colony period 14 months. When the colony period begins in the late summer, brood A emerges in the spring and early summer of the following year and brood B emerges in the late summer and early fall of the following year, making the length of the colony period 12 months.

The eggs, which are laid in a row of slits along one of the serrated edges of the leaf, vary in number from 25 to 218. As a result of there being two periods of adult emergence there are two periods of oviposition and incubation during the year, coincident with those of issuance, the first occurring in the late spring and early summer, particularly May and June, and the second in the late summer and early fall (late July, August, and early September). The period of incubation as determined by the time elapsing between the laying of the first egg and the hatching of the first larva varies from 13 to 21 days, with an average from six experiments of 16 days.

The length of the larval feeding period from hatching out to the appearance of the first prepupa varies from 25 to 31 days, with an average of 28 days. The approximate length of the first stage is 6 days, of the second, third, and fourth 5 days each, and of the fifth and sixth 4 days each. The larvae of the first three stages eat only the epidermis and the immediately adjoining tissue of the needles, but beginning with the fourth stage and continuing through the sixth, they eat the whole of the needle and occasionally portions of the tender bark of the young twigs. Following the larval feeding period comes the prepupal instar, a larval, nonfeeding, cocoon-spinning, quiescent stage. The length of the cocoon period, passed several inches beneath the surface of the ground, from its spinning to the issuance of the adult, varies with the character of the colony, the period between the first cocoon and the first adult from eggs laid in May or June ranging from 13 to 23 days in brood A and from 364 to 379 days in brood B.

This sawfly is said to appear and disappear periodically, being abundant for several years, then for a few years becoming rare. The jack pine (*Pinus banksiana*), the red pine (*P. resinous*), and the scrub pine (*P. virginiana*) are the primary or preferred hosts of the species, and ten species of Pinus and the American larch are mentioned as secondary or possible hosts.

No parasites have been reared from the egg or uncocooned larvæ, but four hymenopterous species, namely, *Exenterus diprioni* Roh., *Lagorotis diprioni* Roh., *L. virginiana* Roh., and *Perilampus hyalinus* Say, and four dipterous species, namely, *Phorocera claripennis* Macq., *Adomonita demylus* Wlk., *Neopales maera* V. d. Wp., and *Spathimeitenis spinigera* Town. A bacterial wilt disease of the larva was observed in Wisconsin in 1912. None of these parasites, nor the wilt disease, has been observed to be sufficiently abundant or effective to account for the periodical disappearance of the species.

"The species does considerable damage to both natural reproduction and nursery stock by defoliating the trees. Complete or nearly complete defoliation before late summer usually kills that part defoliated, and since this insect shows a very decided preference for young trees, and the larvae often are numerous enough to strip the tree entirely of leaves, many young pines are killed by this work alone. Trees not completely denuded often die because in their weakened condition they are attacked by secondary insect enemies. When there is incomplete defoliation and the tree recovers, it is often stunted or misshapen and is of little commercial or ornamental value." In nurseries and in parks, in case of heavy infestation, control can best be obtained by application of arsenate of lead at the rate of 2 lbs. of powder to 50 gal. of water. When less than 3/8 in. long, the larvae are said to be fairly well controlled by the use of nicotin sulphate.

A revision of the genus Fasciola, with particular reference to F. gigantica (Cobb.) and F. nyanzi (Leip.), H. G. Jackson (*Parasitology, 13 (1921), No. 1, pp. 48–56, pl. 1, figs. 4*).—Descriptions and a key for the separation of the species of Fasciola are given.

On the life history of Ascaris lumbricoides L., V, F. H. Stewart (*Parasitology, 13 (1921), No. 1, pp. 37–47, figs. 8*).—This is in continuation of papers previously noted (E. S. R., 42, p. 383).

After presenting a summary of the literature on the subject published during 1919 and 1920, experiments conducted by the author during 1920 are briefly reported upon. The anatomy of the larva of *A. suilla* Duj. found on the nineteenth day after hatching in the intestine of the pig and the development of certain organs in *A. suilla* from the embryo at hatching to the larva are described. The route taken by the larvae of *A. suilla* in their migration through the tissues of the host, the mechanism of protection of the body against the

invasion of Ascaris larvae, and the extent of natural Ascaris infestation of pigs in England and treatment suggested with a view to the eradication of the disease are dealt with.

An hereditary Rickettsia-like parasite of the bedbug (Cimex lectularius), J. A. ARKWRIGHT, E. E. ATKIN, and A. BACOT (*Parasitology, 13 (1921), No. 1, 27–36, pl. 1, fig. 1*).—*Rickettsia lectularia*, a parasite of *C. lectularius*, is described as new.

FOODS—HUMAN NUTRITION.

Nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Wash. Yearbook, 19 (1920), pp. 267–276*).—This is the customary annual report of the nutrition laboratory of the Carnegie Institution (E. S. R., 43, p. 266). The additions to the equipment during the year include a static control recorder for testing the stability of a subject's coordination mechanism when standing with eyes closed. The apparatus employs four movement adders, each of which accumulates the amount of sway in one particular direction. A graphic record is also provided to serve as a check upon the quantitative data.

Brief reports are given of investigations in progress and abstracts of publications issued during the year.

The chemical composition of Texas honey and pecans, G. S. FRAPS (*Texas Sta. Bul. 272 (1921), pp. 5–9*).—Analyses by the Official method are reported of 18 Texas honeys from various plants and 11 varieties of pecans. The average composition of the honeys was as follows: Protein 0.36, reducing sugars 75.71, sucrose 1.17, nonsugars 4.02, water 18.51, and ash 0.23 per cent and direct rotation—15.8. These averages are similar to the averages for American honey reported by Browne (E. S. R., 19, p. 1058).

The average composition of the pecan meats was as follows: Protein 10.66, fat 72.44, crude fiber 2.31, nitrogen-free extract 9.82, water 3.2, and ash 1.57 per cent. Analyses are also reported for four samples of pecan hulls. These are considered, however, to have no food value.

Relation of processing to the acidity of canned foods, W. D. BIGELOW and P. H. CATHCART (*Natl. Canners Assoc. Bul. 17–L (1921), pp. 46, figs. 16*).—In this bulletin, which continues the series of studies dealing with the processing of canned foods (E. S. R., 44, p. 461), the results are presented of a systematic analysis of the acidity of a large number of canned foods in terms of H-ion concentration as determined by the hydrogen electrode method. The data are presented in tables including the description and source of the product, pH values, size of can, and time and temperature of processing.

The range of pH values of representative canned fruits extends from pH=2.9 for plums to pH=7 for lye hominy. Most fruits fall within the range of pH=3 to pH=4 and most vegetables between pH=5 and pH=6. Between pH=4 and 5 are found tomatoes, pimentos, and okra, between 6 and 7 peas and corn, and also salmon, shrimps, and tuna, the only fish products reported.

A comparison of the pH values and temperature of processing shows that, in general, the greater the H-ion concentration the lower the process necessary for sterilization. Among the factors causing exceptions to this rule are variations in heat penetration of different products and variations in preparation of the material, affording a greater or less opportunity for increase of bacteria.

To determine the changes in H-ion concentration during the period of processing, a number of typical products were given the usual preliminary treatment and processed in No. 2 cans for varying periods of time, thus enabling a comparison of pH values of the same kind of material at regular intervals. Factors influencing pH values during processing, as brought out in the results

reported, are the heat of processing, which tends to increase the acidity of foods, particularly in the early stages of the process; the addition of water, sirup, or brine, tending to decrease the acidity; and diffusion, tending to increase the acidity in the case of foods canned alone or with the addition of water, sirup, or brine, and to decrease the acidity in cases of the addition of acid liquor as tomato sauce. The pH changes during the processing of a number of products are given to illustrate the influence of the above factors.

A brief explanation of pH values and H-ion concentration is appended.

Creatinin and creatin in the blood, C. C. Wang and M. L. Dentler (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 237–243*).—Determinations by the method of Folin and Wu (E. S. R., 41, p. 13) of the creatinin and creatin content of the blood of 24 normal women in intramenstrual and menstrual periods are reported, with the following general results:

No regular variation for creatinin or creatin was found during menstruation. The range for creatinin was from 0.96 to 1.65 mg. per 100 cc. with an average value of 1.3 mg., which falls within the range of the figures obtained by previous investigators, chiefly on men subjects, and thus fails to substantiate the theory that blood creatinin is lower in women than in men. No relation was observed between the age of the subject and the amount of creatinin eliminated. The range for creatin was from 2.23 to 4.65 mg. per 100 cc., the results being slightly lower than those reported by other observers.

A study was also made of the influence of sugar on blood creatinin and creatin. The figures for creatinin were, with one exception, higher on the high than on the low sugar diet. The creatin readings were not so noticeably affected.

The food requirements of children.—I, Total caloric requirements, L. E. Holt and H. L. Fales (*Amer. Jour. Diseases Children, 21 (1921), No. 1, pp. 1–28, figs. 12*).—This is the first of a series of papers on the general subject of the food requirements of the child during the whole period of growth, the discussion in this paper being limited to the different factors which must be considered in the estimation of the total calories. The observations of various authors are reviewed and discussed, and original observations are reported on over 100 normal children of both sexes from 1 to 16 years of age.

The component parts of the total caloric requirements of children are considered to be the requirements for basal metabolism, growth, muscular activity, and the food values lost in the excreta. For the basal requirement the authors accept the values given by Benedict (E. S. R., 43, p. 166) as representing the irreducible minimum. The food value normally lost in the excreta, as estimated from the observations of various workers, is calculated as 10 per cent of the total calories for all except nursing infants who utilize a much higher percentage of the total food intake.

The requirements for growth have been estimated by multiplying 80 (the number of calories estimated by Rubner as needed daily to increase the weight of the body 1 kg. in one year) by the average increase in kilograms per annum. On this basis it is shown that the requirements for growth are greatest during the first years of life and during adolescence and are nearly uniform from the fourth to the tenth or eleventh year. The average of the requirements for basal metabolism, growth, and loss in excreta is shown to be nearly uniform for children of the same weight living under similar conditions, while the requirement for activity varies widely. It is the opinion of the authors that in many estimates of total caloric requirements for children this factor has not been taken into account sufficiently. It is also emphasized that underweight children require more calories per kilogram and overweight fewer calories than those o

average weight. The tentative schedule of average caloric requirement is given as follows:

"The average caloric requirement of children according to our observations is about 100 calories per kilogram at an age of 1 year (about 9.5 kg.). For boys it falls to about 80 calories at 6 years (about 20 kg.) and remains practically constant at this value up to the age of 15 years, the increasing requirements for activity being met by the reduction in basal requirements per kilogram. After a weight of 50 kg. (about 15 years) is reached the calories per kilogram can rapidly be reduced to adult standards, about 48 calories per kilogram. The requirement for girls falls to 76 calories per kilogram at 6 years (about 20 kg.), continues at this value until the tenth year. During the tenth year it rises because the basal requirement is nearly constant while there is an increase in needs for growth and activity. The requirement remains at 80 calories per kilogram until growth is complete, then falls rapidly to adult standards, about 44 calories per kilogram."

In comparing this schedule with those proposed by others, the authors call attention to the fact that they have allowed a much higher value for calories per kilogram during adolescence than have others. This is thought to be absolutely essential because of the increased growth needs and the large requirement for muscular activity at this period.

The question of the practical significance of the nutritive value conception with remarks on the minimum fat requirements of infants, F. von Gröer (*Biochem. Ztschr., 97 (1919), No. 6, pp. 311–329*).—The author describes two cases from Von Pirquet's infant clinic in Vienna of infants who were apparently satisfactorily nourished during the first six months of life on a diet of highly centrifugated milk supplemented with cane sugar to give the proper caloric value. Although both of these children showed signs of interrupted growth during this period and suffered from the prevailing epidemic of grippe, the general condition and weight at the end of the period was such as to lead the author to the conclusion that the theoretical fat minimum of the human infant as shown by these two experiments is so small as to be practically negligible. He thus takes exception to the conclusions of Aron previously noted (E. S. R., 41, p. 264) that a minimum of fat is essential to proper nutrition. The question of vitamins is apparently neglected in this study, and the emphasis is laid solely on a minimum of protein supplemented by sufficient energy value to be obtained either from carbohydrate or fat, interchangeable according to their isodynamic value. It is, however, suggested that the isodynamic principle can be applied with greater safety if equicaloric amounts of actual foods are considered rather than equicaloric values of purified food constituents.

The nutritive value and significance of food fats, H. Aron (*Biochem. Ztschr., 103 (1920), No. 4–6, pp. 172–177*).—In this reply to the foregoing paper the author points out that the two cases mentioned by Von Gröer showed signs of lowered nutritive condition early in the experiment, and states that while infants can develop for a short time on a fat-free diet, failure to continue to grow and a lowered resistance to infectious diseases ultimately result. He further emphasizes that all fats are not interchangeable in their special or biological food value, citing in illustration that butter can not be replaced by vegetable fats or egg-yolk fat by lard and that liver oil is particularly good for children.

Grippe and whooping cough, Niemann (*Berlin. Klin. Wchnschr., 56 (1919), No. 33, pp. 777–779*).—In discussing an epidemic of grippe and whooping cough among about 50 children in Berlin, attention is called to the course of the disease among infants fed in different ways. Eleven of these infants were

being fed on a fat-rich food including breast milk, protein milk, and a butter-flour preparation, while an equal number were fed on skim milk enriched by sugar. The fact that there were 9 fatalities in the second group and only 3 in the first is thought to indicate that children fed on a diet containing considerable fat have a higher resistance to infection than those on a carbohydrate-rich diet.

Growth on diets poor in true fats, T. B. OSBORNE and L. B. MENDEL (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 145–152, fig. 1*).—The authors point out that the controversy regarding the necessity for fats in the diet as noted in the above papers fails to emphasize adequately the distinction in the significance of fats as sources of energy and as carriers of vitamins and of lipoids whose real significance is still unknown. In regard to the report of Von Gröer in particular it is pointed out that centrifugated milk is not entirely free from either fat or fat-soluble vitamin; that it is not certain whether or not young animals have a store of this factor which only gradually becomes exhausted; and that the period of observation of the infants on the fat-free diet was too brief to be of real value.

To throw more light on the question of the dispensability of fat in the diet, new feeding experiments with rats have been conducted with diets consisting of meat residue 23 per cent (yielding 1.6 per cent ether extract), starch 72, and salt mixture 5 per cent. The necessary vitamins were given in tablets containing 0.4 gm. of brewery yeast, 0.2 gm. of dried alfalfa, and 0.2 gm. of cane sugar. These were fed apart from the rest of the food, which was given ad libitum. In two cases the amount of alfalfa was increased to 0.4 and 1 gm., respectively, after a short time. The three animals grew on this ration with vigor.

Another experiment was conducted on three more rats with a diet differing from the first only in that the meat residue was extracted five times with ether containing a little alcohol. On this diet, furnishing at the most a daily intake of 0.078 gm. of ether extract during a period when the weekly food intake was as high as 174 gm., the rats quadrupled their weight in usual time and appeared as well nourished as control rats on a diet containing liberal portions of fat. The authors conclude that "if true fats are essential for nutrition during growth, the minimum necessary must be exceedingly small."

Recent advances in science in their relation to practical medicine and the nutritional requirements of the body, F. G. HOPKINS (*Lancet [London], 1921, I, No. 1, pp. 1–7*).—In this Huxley lecture before the Medical School of the University of London, the author discusses the standards of nutrition from the opposing viewpoints of the law of isodynamic equivalence and the law of the minimum.

The law of isodynamic equivalence, so named by Rubner, was treated on the theoretical side by a discussion of Rubner's teaching that any one foodstuff can replace any other so long as the replacement makes no change in the supply of energy, and on the practical side by a brief account of Von Pirquet's new system, which is also based primarily upon calorimetry. In contrast with these claims the newer conceptions of food requirements are briefly discussed, including the limits of interchangeability of fat and carbohydrate as recently discussed by Krogh and Lindhard (E. S. R., 44, p. 463), the differing nutritive values of various proteins, and finally the vitamin requirements. It is shown that the law of isodynamic equivalence fails in the light of these newer conceptions, and that a much more significant principle in nutritional phenomena is the law of the minimum, the working of which is outlined as follows:

"What we have actually to recognize is that each of several factors may become that which limits efficiency, and that no one of these is in any strict sense more important than any other. Normal nutrition calls for a certain

minimum of each one and every one. If a diet is harmoniously balanced in a chemical sense, then indeed energy does become the sole limiting factor. Nutrition then fails, of course, only when too little of the diet is eaten to yield the essential minimum of energy. But the supply of fat may become the limiting factor, and no less that of carbohydrate. Or, again, when the supply of energy consumed is ample, with fat and carbohydrate duly adjusted, the circumstance that a single essential amino acid in one case, or a vitamin in another, is present in amount below the necessary minimum converts each of these in turn into the factor which limits utilization. Small as the necessary minimum in either case may be, unless it is reached the proper use of the rest of the diet is reduced to a degree which is proportional to the deficiency. If the deficiency be complete normal utilization is altogether impossible."

In discussing the relations of vitamin and protein deficiency to disease, brief reference is made to scurvy as illustrating the former and pellagra as in part due to the latter deficiency. The author emphasizes, however, that "if the application of all these considerations to practical medicine bore only upon the production of actual disease they would have far less importance than, in my belief, is actually attached to them. A deficiency which when extreme produces actual disease will, almost certainly, when less extreme involve some failure in health."

Vitamin studies.—VI, The influence of diet of the cow upon the nutritive and antiscorbutic properties of cow's milk, R. A. DUTCHER, C. H. ECKLES, C. D. DAHLE, S. W. MEAD, and O. G. SCHAEFER (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 119–132, figs. 5*).—In continuation of the vitamin studies from the Minnesota Experiment Station (E. S. R., 43, p. 664), an extensive investigation is reported of the influence of fresh and dry feed or summer and winter feed on the antiscorbutic value of cow's milk. It is pointed out that the experiments conducted in this study differed from a similar study reported from the Wisconsin Station by Hart et al. (E. S. R., 43, p. 766) in that the milk was derived from the same cows throughout the experiment, while in the Wisconsin study the comparison was made on milk from two different herds.

In the present study two cows, a Jersey and a Holstein, were placed in the middle of January upon a vitamin-poor ration of equal parts of middlings, gluten feed, ground oats, and ground barley, adjusted to satisfy the requirements of the animals and supplemented by a roughage of equal parts of chopped timothy hay and oat straw. Mixed milk from the two cows was fed in varying quantities to several groups of guinea pigs, new groups being added from time to time. On June 1 the cows were put to pasture, the winter ration being continued, but in much smaller amounts, and the feeding experiment with the guinea pigs continued during the summer.

The data obtained showed conclusively that the antiscorbutic value of cow's milk is dependent upon the antiscorbutic value of the ration ingested by the cow. Greater protection against scurvy was obtained with 20 cc. of summer milk than with 60 cc. of winter milk. Milk obtained two weeks after the cows had been placed upon the vitamin-poor ration was much richer in antiscorbutic vitamin than that obtained a month later, indicating a slight storage of vitamin in the cow. Response to the vitamin-rich ration was very rapid, being noticeable within two weeks after the cows were put to pasture.

It is stated that similar studies are in progress with regard to vitamin A and vitamin B.

Relation of fodder to the antiscorbutic potency and salt content of milk, A. F. HESS, L. J. UNGER, and G. C. SUPPLEE (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 229–235, figs. 2*).—The authors have studied the relation of feed to the antiscorbutic value of milk by a method differing from that of Hart et al. (E.

S. R., 43, p. 766) mainly in a delimitation of the duration of the feeding periods and in the inclusion of a chemical examination of the milk.

Five grade Holstein cows which had been freshened about 2 months previously were stall-fed through the winter on a normal winter ration of silage, hay, and concentrates. On April 30, 1920, they were put on a daily ration of 25 lbs. of a concentrate mixture consisting of 1 part of bean meal, 2 parts of oil meal, 2 parts of hominy, 2 parts of gluten meal, and 2 parts of bran, and also received 8 lbs. of kiln-dried beet pulp, 4 qts. of molasses, and 12 lbs. of straw. After 3 weeks on this ration, during which time there was a considerable decrease in milk flow, a mixed sample of milk from the 5 cows was obtained and evaporated by means of the Just roller process at a temperature of 230° F. for a few seconds. The cows were then placed on pasture for 3 weeks, during which time, except for the first 2 or 3 days, in which some concentrates were given, they received only fresh grass. At the end of 3 weeks another mixed sample of the milk was taken and dried as before. This procedure made it possible to test both varieties of milk at the same time and to use identical products for as long a period as necessary.

Guinea pigs were fed oats and bran ad libitum plus 80 cc. of the dried milk diluted with water to its original content. All of the 5 guinea pigs fed with dry-fodder milk developed scurvy within 21 days and died within 56 days, while the 3 animals fed on the pasture milk were all alive after 120 days, 2 showing mild signs of scurvy.

These experiments are thought to show not only the marked difference in antiscorbutic values of the two kinds of milk but also that the antiscorbutic vitamin is rapidly secreted into the milk by the lacteal glands and not stored in the body.

Chemical analysis of the milk, using the liquid milk in every determination except that of lecithin in which the dried milk was used, showed similarity in results except in the percentages of calcium, phosphorus, and citric acid, which were all higher in the pasture milk, and of sulphur, which was somewhat lower in the pasture milk, although the protein was a trifle higher.

"The percentages of calcium and of phosphorus in the antiscorbutic-free milk are below the normal; those of the pasture milk are within normal limits. The question of a casual relationship naturally suggested itself between the lack of antiscorbutic vitamin and the decreased excretion of these salts into the milk. A conclusive answer to this question must be postponed, however, until further data are available. The increase in citric acid may be explained in part by the greater amount of citrates contained in the green fodder, but gains added interest in view of the close association between citric acid and many of the most potent antiscorbutic foodstuffs. In view of the marked variation of this constituent in the two varieties of milk, normal figures which have been established without regard to the fodder of the cows must be regarded as incomplete. In fact, a lesson to be derived from this chemical examination of antiscorbutic-free and of pasture milk is the danger of setting up rigid standards for milk constituents and the necessity of prefacing such results with full data as to the diet of the lactating animal."

Production of polyneuritis in pigeons by the use of a synthetic ration. H. SIMONNET (*Compt. Rend. Soc. Biol.* [*Paris*], *83* (*1920*), *No. 35, pp. 1508–1510*).—Attention is called to the deficiency in one or more factors of the basal diets commonly used in the study of avian polyneuritis. The ration used by the author has the following composition: Meat residue prepared by double extraction with boiling alcohol and ether 11 gm., Osborne and Mendel's salt mixture 4, pulverized agar 5, peanut oil heated for 3 hours at 130° C. 5, cellulose 5,

butter melted, decanted, and filtered at a temperature below 40° 10, and potato starch 60 gm. These ingredients are intimately mixed with 80 per cent of their weight of water and made into pellets, which are introduced into the crops of the experimental pigeons in two daily doses in amounts equal to one-fifth the weight of the bird. The pigeons are kept in very large cages to allow considerable freedom.

On the above diet the pigeons are said to maintain their weight but to develop a spasmodic form of avian polyneuritis unaccompanied by paralytic and atrophic symptoms, in the development of which inanition and multiple deficiencies are considered to play the important rôle. The disease appears generally in about 30 days, and is usually fatal in about 4 days if no treatment is given. The administration of dry or autolyzed yeast brings about prompt recovery. By supplementing the deficient ration by the administration of 0.5 gm. of dried yeast daily, the pigeons can be maintained in excellent health for more than 7 months.

Further experiments for preservation of lemon juice, P. W. Bassett-Smith (*Lancet [London], 1920, II, No. 20, pp. 997, 998, fig. 1*).—Lemon juice concentrated as previously described (E. S. R., 44, p. 361) has been shown to keep indefinitely without molding or fermenting. Boiling the lemon juice for 5 minutes before concentrating was found not to diminish appreciably its antiscorbutic content, but heating it at 58° C. for 45 minutes diminished it to a marked degree as shown by feeding experiments with guinea pigs. In connection with these experiments the author notes that the addition of 1 cc. of fresh blood to a basal scorbutic diet did not prevent the onset of scurvy.

Botulism, E. C. Dickson (*Amer. Jour. Pub. Health, 10 (1920), No. 11, pp. 865–871*).—This is a general discussion of the subject, with particular reference to the relationship of *Bacillus botulinus* to the preservation of foods whether at home or commercially. It is emphasized that boiling canned foods will always render them safe with respect to botulinus toxin, but that canned foods that show any signs of spoilage should be destroyed.

Botulism (*Med. Sci., Abs. and Rev., 3 (1921), No. 5, pp. 411–414*).—A review of recent literature, most of which has been noted from the original sources.

Absorption and elimination of manganese ingested as oxids and silicates, C. K. Reiman and A. S. Minot (*Jour. Biol. Chem., 45 (1920), No. 1, pp. 133–143*).—To determine the possibility of manganese poisoning among workers with manganese ores, a study in vitro was made of the solubility of manganese compounds in gastric juice and in vivo of the effect of ingested manganese ores on the manganese content of the blood and the manner of its elimination. The effect on the blood and tissues of dogs of prolonged feeding of large amounts of manganese ores was also determined.

Although ores containing manganese as oxids and silicates were soluble in gastric juice and the manganese was absorbed in the blood stream, a rapid return to normal manganese content was almost universally the case. Prolonged feeding of large amounts of manganese to dogs failed to cause any pathological symptoms. "Manganese ores are thus very nontoxic and in order to produce symptoms of poisoning must be ingested by individuals who are peculiarly susceptible. Clinical experience has demonstrated that such persons are extremely rare."

ANIMAL PRODUCTION.

Report of the committee on genetic form and nomenclature, C. C. Little et al. (*Amer. Nat., 55 (1921), No. 637, pp. 175–178*).—This report to the American Society of Naturalists deals mostly with the method of designating genes. It is suggested that subscripts be used to distinguish between different series of

allelomorphs where the literal symbols are the same, and that superscripts designate allelomorphs when there are more than two in a series.

Genetics of the "chinchilla" rabbit, W. E. CASTLE (*Science, n. ser., 53 (1921), No. 1373, pp. 387, 388*).—The author reports breeding experiments with rabbits having the so-called chinchilla coat, that is a pearl-gray color similar to the color of the wild rabbit but with the yellow ticking replaced by white and the black portions toned down to a slaty blue. Chinchilla is the fourth member of the albino series of allelomorphs and is recessive to normal pigmentation and dominant to Himalayan and ordinary albinism. It is suggested that large chinchilla pelts, for which there is a demand in the fur trade, could be secured by mating pure chinchillas to white Flemish. The meat characters and the quality of the pelt could be further improved without loss of the chinchilla color by continued crossing back to the white Flemish.

The formation of the secondary sexual characters by the gonads, A. LIPSCHUTZ (*Arch. Entwickl. Mech. Organ., 44 (1918), No. 2, pp. 396–410*).—This is a review of a large number of published castration and gonad-transplantation experiments. A sharp distinction is made between characters influenced by the gonads and those due to the "asexual embryonic form." The latter group includes the feathering and spurs of cocks and perhaps the combs and wattels of hens, but no clear cases among mammals are cited.

The influence of ovarian hormones on the growth of the pelvis, I. R. PLAUT (*Hoppe-Seyler's Ztschr. Physiol. Chem., 111 (1920), No. 1, pp. 36–42*).—Five young rabbits, 2 young cats, and 1 young guinea pig received subcutaneous injections of the ether extract of the ovary of the cow for 2 or 3 weeks and then after a period of observation were killed. Litter mates furnished the controls.

It was found that the pelves of the injected animals tended to approach the adult form, particularly when the ovary furnishing the extract contained a corpus luteum. The change was shown by a widening of the angle of the pubes and variations in the mutual ratios of the three diameters measured.

On the composition and digestibility of a reed (Arundo phragmites) and a bullrush (Scirpus maritimus), F. HONCAMP and E. BLANCK (*Landw. Vers. Sta., 90 (1917), No. 1–2, pp. 113–122*).—Digestion experiments with sheep are reported.

The percentage composition (dry basis) of the reed was as follows: Crude protein 7.59, ether extract 1.28, crude fiber 37.48, and nitrogen-free extract 44.47. On an average the two sheep digested 33.3 per cent of the organic matter, 36.5 of the crude protein, 40.6 of the crude fiber, and 26.6 per cent of the nitrogen-free extract. The bullrush on a water-free basis contained 10.29 per cent of crude protein, 2.2 per cent ether extract, 30.98 per cent crude fiber, and 46.02 per cent nitrogen-free extract. The average digestion coefficients of the two animals were as follows: Organic matter 43.3, crude protein 42.6, crude fiber 51.7, and nitrogen-free extract 37.6.

Molinia hay: Its composition and feeding value, F. HONCAMP and O. NOLTE (*Landw. Vers. Sta., 93 (1919), No. 1–2, pp. 91–95*).—Hay made from *Molinia coerulea* cut in an early stage was used in digestion trials with two sheep. On a water-free basis the hay had the following percentage compositions: Crude protein 15.34, crude fat 2.33, crude fiber 26.24, and nitrogen-free extract 50.67. The mean digestion coefficients were: Organic matter 65.5, crude protein 71.8, crude fat 27.9, crude fiber 66.3, and nitrogen-free extract 64.9.

A comparative study of the composition of the sunflower and corn plants at different stages of growth, R. H. SHAW and P. A. WRIGHT (*Jour. Agr. Research [U. S.], 20 (1921), No. 10, pp. 787–793*).—In this study from the Dairy

Division of the U. S. Department of Agriculture chemical analyses were made of the sunflower plant and the corn plant at different stages of growth.

It was found for both species that the percentage of dry matter increased gradually and consistently throughout the growth period, and that the percentage of crude protein in the dry matter decreased. The two species differed chiefly in the carbohydrates. The starch content of the corn increased rapidly after the milk stage, reaching a maximum (nearly 25 per cent of the dry matter) at the stage when all the kernels were glazed. In the sunflower the maximum starch content (4.6 per cent of the dry matter) occurred before the formation of the first flowers and thereafter declined irregularly. In the corn plant the reducing sugars were greatly in excess of the nonreducing sugars throughout and the sugar content was at a maximum at the time the kernels were forming. In the sunflower the difference in the amounts of the two classes of sugar were less marked, and in the first stage when the plants were 3 ft. high the nonreducing sugars were in excess. The sugar content was highest in the early stages and declined steadily as maturity was reached.

From a study of the composition it is concluded that the stage in which the ray flowers have become dry and are beginning to fall is the best for harvesting sunflowers destined for silage.

Sunflower silage digestion experiment with cattle and sheep, R. E. Neidig, R. S. Snyder, and C. W. Hickman (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 881–888*).—At the Idaho Experiment Station 7-day digestion trials were made with three Shorthorn cows and three Shropshire wethers fed sunflower silage that had been cut when about 50 per cent of the flowers were still in bloom and only a few of the seeds had reached the dough stage. The moisture content of the silage was 78.79 per cent, and on the dry basis it contained 9.59 per cent crude protein, 5.82 per cent ether extract, 29.72 per cent crude fiber, and 45.03 per cent nitrogen-free extract. The average digestion coefficients for the cows were as follows: Dry matter, 51.7; crude protein, 47.8; ether extract, 73.7; crude fiber, 37.4; and nitrogen-free extract, 56.3. The averages for sheep were: Dry matter, 58.8; crude protein, 54.4; ether extract, 77.4; crude fiber, 46.7; and nitrogen-free extract, 69.8. The apparent digestibility of the ash was 26.6 per cent with the cows and 38.5 with the sheep.

Attention is called to differences between the experimental animals of the same species in ability to digest the silage, but it is thought that the averages are representative, since the percentages of digestible nutrients resemble those in the sunflower silage used in digestion trials at the Montana Station. (E. S. R., 43, pp. 68, 770.)

Bacteria concerned in the ripening of corn silage, P. G. Heineman and C. R. Hixson (*Jour. Bact., 6 (1921), No. 1, pp. 45–51*).—Silage from three silos was sampled periodically from November to June for chemical and bacteriological study.

The fermentation was found to consist of three phases, each brought about by a characteristic group of bacteria. The initial phase, of short duration, is caused by members of the colon aerogenes group, and is accompanied by the formation of acid and gas. The second phase is characterized by the presence of streptococci and the moderate formation of acid. In the early and more active stage the streptococci appear chiefly in the diplococcus form, but later chain formation is more common. The third phase is the result of the activity of lactobacilli, of which a slow-growing and a rapid-growing type were recognized. Evidence of butyric acid bacilli could not be found, and there was no significant growth of yeast, although yeast cells were invariably present.

Cellulose as a feeding stuff, H. EDIN (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 168 (1918), pp. 15, fig. 1; also in K. Landtbr. Akad. Handl. och Tidskr., 57 (1918), No. 4, pp. 278–290, fig. 1*).—Digestion trials are reported with goats fed various kinds of paper pulp in conjunction with "cake" and sliced sugar beets. Using digestion coefficients for the concentrates and beets determined in other experiments, the following results were secured:

Composition and digestibility of paper-pulp feeds.

Paper pulp feeds.	Composition.[1]				Digestibility (goats).		
	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Organic matter.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Straw pulp-wet mass	1.07	0.79	64.39	19.15	76.6	83.8	57.3
Straw pulp and molasses—air dry	1.99	.59	55.88	25.97	88.0	92.5	86.3
Fir wood sulphite pulp—dried and ground	.12	.81	69.12	18.61	86.6	93.4	70.5
Fir wood sulphate pulp—dried and ground	.15	.24	72.82	15.45	88.4	95.8	63.3
Fir wood sulphate pulp—in pulp form	.....	.....	.....	.....	91.3	98.6	57.0

[1] Reduced to a uniform moisture content of 10 per cent.

Feeding experiments are also reported in which paper pulp formed a satisfactory partial substitute for oats in the ration of horses.

On the inheritance of ear length in sheep, C. WRIEDT (*Ztschr. Induktive Abstam. u. Vererbungslehre, 20 (1919), No. 3, pp. 262, 263*).—The author reports a limited amount of data on the inheritance of ear length in Norwegian sheep. In one flock where short-eared sheep occurred matings of long-eared sheep alone never produced short-eared lambs, while short-eared×long-eared matings did give rise to short-eared lambs. These data confirm the conclusions of Ritzman (E. S. R., 35, p. 772) that the short-ear character is dominant to the long ear. However, in another part of the country there was a farm where earless sheep occurred, and in a short-eared×short-eared mating in this flock there were produced 2 short-eared and 2 earless lambs. The author is inclined to lump these 4 lambs with the 1 long-eared and 3 short-eared lambs secured by Ritzman from a short-eared×short-eared mating, and to conclude that the short-ear condition is the heterozygote intermediate between long ears and earless.

The short ears observed in these flocks were about 4 cm. long and were in all cases sharply marked from the long-ear type.

Breeding earless sheep, E. G. RITZMAN (*Jour. Heredity, 11 (1920), No. 5, pp. 238–240, figs. 4*).—In breeding experiments at the New Hampshire Experiment Station in which short-eared rams known to have a long-eared parent were mated to long-eared ewes there have been produced 16 short-eared and 16 long-eared lambs. Matings between a short-eared ram and short-eared ewes have produced 1 earless, 3 short-eared, and 1 long-eared lamb. The author therefore modifies his previous conclusion (E. S. R., 35, p. 772) that short ear is dominant to long ear, and concludes that the short-eared condition is the heterozygote intermediate between earless and long ears.

[Costs and profits in sheep farming], S. C. HARTMAN (*Ohio Sta. Bul. 344 (1920), pp. 357–360, fig. 1*).—Records of costs, feeding consumption, and labor in connection with a flock of sheep at the Washington County Experiment Farm (Southeastern Ohio) in 1918 and 1919 are presented, together with a brief

analysis of the factors affecting profits in sheep and wool production. The importance of the lamb crop is emphasized.

Summer hog feeding, H. J. GRAMLICH (*Nebraska Sta. Bul. 176 (1920), pp. 20, figs. 5*).—Two hog feeding experiments are reported, of which the second has already been noted from Bulletin 245 of the Nebraska Board of Agriculture (E. S. R., 41, p. 675).

The first experiment began May 26, 1917, lasted 45 days, and involved four lots of 10 hogs each. The methods of feeding and the results obtained are summarized in the following table:

A 45-day comparison of tankage and semisolid buttermilk for hogs on pasture and in the dry lot.

Lot.	Pasture.	Initial weight per head.	Ration (free choice).			Daily gain per head.	Consumed per pound of gain.		
			Corn.	Tankage.	Buttermilk.		Corn.	Tankage.	Buttermilk.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	None	143.3	6.4	0.36	.....	1.76	3.63	0.20	.....
2	Rape	142.3	7.5	.25	.....	2.06	3.65	.12	.....
3	None	144.3	8.5	.....	1.24	1.93	4.41	.....	0.64
4	Rape	144.0	8.7	.....	1.24	2.26	3.85	.....	.55

Heredity in horses, H. K. BUSH-BROWN (*Jour. Heredity, 11 (1920), No. 5, pp. 215–227, figs. 12*).—The author has examined the skeletons of Arab horses in museums and elsewhere and finds that they uniformly have only five lumbar vertebrae. The Thoroughbred, however, usually has six. The reduction in number is due to the loss of the sixth vertebra and not to the development of ribs on the first. The great endurance of the Arab in long-distance tests is attributed to the mechanical advantages of the shortened back. It is also stated that the ass has only five lumbar vertebrae.

Use of synthetic diets in the growth of baby chicks.—A study of leg weakness in chickens, E. B. HART, J. G. HALPIN, and H. STEENBOCK (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 421–442, pls. 2, figs. 23*).—The authors, working at the Wisconsin Experiment Station, used a synthetic ration for baby chicks composed of purified casein, dextrin, butter fat, brewers' dried yeast, and a complex salt mixture. This ration given alone or mixed with agar, phenolphthalein, lactose (10 per cent of the ration), sand, or fuller's earth produced leg weakness and early death. Since leg weakness was not prevented by feeding green cabbage, green clover, or orange juice, it is concluded that the condition is not a chicken scurvy. The use of filter paper, as suggested by Osborne, Mendel et al. (E. S. R., 40, p. 876), resulted in normal growth without leg weakness provided the paper was intimately incorporated with the feed. Filter paper to the extent of 10 per cent of the ration gave the best results. The inclusion of dirt or charcoal in the feed prevented leg weakness to some extent.

It was thought that the roughages might function in preventing leg weaknesses by absorbing the toxic material generated in the intestinal tract, but no evidence could be found by means of the precipitin reaction that food proteins as such were traversing the intestinal wall in cases of leg weakness. Although fowls suffering from leg weakness appear anemic, the hemoglobin content of the blood was found not to be subnormal.

Green feed v. antiseptics as a preventive of intestinal disorders of growing chicks, A. G. PHILIPS, R. H. CARR, and D. C. KENNARD (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 869–873; abs. in Indiana Sta. Rpt. 1920, pp. 31, 32*).—As a contribution to the technique of raising chicks in confinement, the authors report a 14-week experiment at the Indiana Experiment Station with 10 lots of 16 newly hatched White Leghorn chicks in which an attempt was made to discover what additions to a basal ration of cracked corn, corn meal, corn bran, meat scrap, soy bean meal, and a mineral mixture would reduce the mortality due to intestinal disturbances.

The check lot which received the basal ration without additions showed the lowest mortality (no deaths) during the first 8 weeks and the highest mortality (6 deaths) during the critical period following the eighth week. In the 2 lots fed pulped strawboard there were 3 deaths during the last 6 weeks and 11 during the first 8. The addition of straw to the ration of 1 lot and straw and sprouted oats to that of another was accompanied in each case by 3 deaths in the first period and 5 in the second, and the average weights of the surviving chicks at 14 weeks were lower than in any of the other lots. Data from 4 lots used in other experiments are cited in confirmation of the conclusion that sprouted oats do not reduce mortality.

The feeding of lactose seemed to be without value in reducing mortality or promoting growth, due, it is thought, to the absence of sugar-splitting enzyms in the bird's intestine as suggested by Mendel and Mitchell (E. S. R., 20, p. 265). The addition of tobacco dust retarded growth in the early stages and made the birds nervous. Sulphur in the feed reduced mortality somewhat in the second period and acted as a laxative. In the pen where hydrochloric acid was added to the drinking water there were 4 deaths in the first period and only 1 in the second, and growth approximated that of the check lot. The addition of 1 part of copper sulphate to 100 parts of drinking water was tried with one lot; there were only 2 deaths—both in the first 8 weeks—and the growth was greater than in any other lot.

Data on the nitrogen excretion are included. The excreta of the chicks receiving hydrochloric acid or tobacco dust showed a low nitrogen content, which is attributed to a lowered elimination of uric acid since the decrease was most marked in the fraction of the excreta not soluble in N/10 HCl.

[Poultry feeding experiments at Purdue University] (*Indiana Sta. Rpt. 1920, pp. 30, 31*).—A pen of 30 White Plymouth Rock pullets fed wheat, oats, bran, and shorts (2:1:1:1) without supplement laid 50.7 eggs per bird. A similar pen given 1.6 lbs. of meat scrap with 25 lbs. of the basal ration laid 106.2 eggs, and other pens fed 2, 3, and 4 times this amount of meat scrap produced 106.9, 109, and 110.9 eggs, respectively.

White Leghorn pullets fed corn, wheat, oats, bran, and shorts (3:1:1:1:1) without supplement laid 65.4 eggs per bird. The addition of dried buttermilk increased the production to 193.4 eggs, but the use of liquid buttermilk in place of the dried buttermilk reduced the yield to 158.5 eggs.

Feeding laying hens, A. G. PHILIPS (*Indiana Sta. Circ. 101 (1921), pp. 16, figs. 5*).—This consists of directions for feeding hens, based mainly on results secured at the station.

British egg-laying tests or trials, E. BROWN (*Rel. Poultry Jour., 28 (1921), No. 1, pp. 65, 66, 104–106, figs. 4*).—This is a survey of the development of the egg-laying tests in the British Isles. The author deplores the tendency for these trials to degenerate into mere competitions and urges that they be organized to increase knowledge of poultry breeding.

Size of egg in relation to average production, E. BROWN (*Jour. Min. Agr. [London], 28 (1921), No. 1, pp. 63–70, figs. 4*).—This is a study of the weights of

eggs laid during the 1918–19 small flocks laying trials at the Harper Adams College. It was found that the increase in the size of the eggs during the first two or three months of the laying year parallels the increase in percentage production, but that size is maintained later in the season when production declines. It is thought that heavy annual production rather than heavy winter production as such tends to increase the proportion of underweight eggs.

[Reports of the 1918–19 and 1919–20 egg-laying trials at the Harper Adams College] (*Utility Poultry Jour., 4 (1919), No. 11, pp. 13, 15, 17, 19, 21, 23, 25, 27, 43–45, 47, 49, 51, 53–55, 57–74, figs. 5; Sup., pp. 3–15, 17–24; 5 (1920), No. 12, pp. 588–599, 617–632*).—These are the reports of the seventh and eighth annual egg-laying trials held at Newport, Shropshire, and continue those previously noted (E. S. R., 41, p. 370).

A progeny test of a limited number of male birds is announced to begin in the spring of 1921. Each cock will be mated to 5 hens whose pullet egg records ranged from high to low in a previous trial. Six daughters from each of these hens will be tested for a year under laying trial conditions.

Final results of live stock for the year 1919–20, and report thereon, W. L. Johnston (*So. Aust. Statis. Dept. Bul. 2 (1920), pp. 6*).—Statistics are given for the year ended June 30, 1920, as to the numbers of cattle, horses, sheep, pigs, goats, and other stock in the several political divisions of South Australia, together with information on the market prices of stock, the wool clip, and dairy production.

DAIRY FARMING—DAIRYING.

Observations on the body temperature of dry cows, M. Kriss (*Jour. Agr. Research [U. S.], 21 (1921), No. 1, pp. 1–28, figs. 46*).—Observations of the body temperature of two dry cows (Jerseys) were made at the Pennsylvania Institute of Animal Nutrition during 16 weeks in the winter of 1919–20. Except when changed for experimental purposes, the cows were kept on a maintenance ration, were fed twice a day (6 a. m. and 5 p. m.) and were watered once a day (8 a. m.).

It was found that the rectal temperatures were usually higher than the vaginal temperatures, the average difference at a depth of 7 in. being about 0.3° F. Since the vagina is more exposed to the atmosphere, the rectum is considered the most suitable place for making temperature determinations. Insertion of the thermometer at different depths showed distinctly lower temperatures toward the exterior and the readings did not approach a constant figure until a depth of 6 or 7 in. was reached.

A falling temperature invariably followed the drinking of water, while feeding raised the temperature slightly during the following half hour. Neither defecation nor the position of the animal (whether lying or standing) seemed to influence the temperature to any important extent, but there was some indication of a slight fluctuation in temperature immediately after a change in position. Aside from the influence of water drinking the temperature remained practically constant until about 2.30 p. m., when a gradual rise began.

A difference of 0.8° in the rectal temperature of the same animal at 5 p. m. on two successive days was observed. Readings made on successive days at 9 a. m. varied as much as 1.3°, due to the influence of drinking. Apparently the daily fluctuations at 5 p. m. are not considered large enough to interfere with the accurate determination of heat production in 24 or 48 hour respiration calorimeter experiments.

Environment and breeding as factors influencing milk production, A. C. McCandlish (*Jour. Heredity, 11 (1920), No. 5, pp. 204–214, figs. 11*).—This is

a summary of an experiment in grading up dairy cattle previously noted from Iowa Station Bulletin 188 (E. S. R., 41, p. 182), with some additional data and new photographs of the cows. Twelve second generation cows have completed 19 lactations, and their average milk record corrected to maturity averaged 116 per cent higher than the similarly corrected lactation records of their scrub granddams. The fat production averaged 106 per cent higher. The Holstein grades showed greater relative increases than the Guernsey and Jersey grades. Eight first generation cows that were mothers of second generation heifers with lactation records gave 55 per cent more milk and 44 per cent more fat than their scrub dams.

The value of the purebred sire in increasing the production of a scrub herd, A. C. McCandlish (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 12–23, pls. 5*).—This contains essentially the same material as in the paper noted above, but the data are given in greater detail.

Corn stover silage v. corn silage for milk production, F. B. Morrison, G. C. Humphrey, and R. S. Hulce (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 29–31*).—At the Wisconsin Experiment Station 8 cows were divided into two groups and fed corn silage or corn stover silage by the reversal method during two 4-week periods. The grain and hay rations were not varied with the kind of silage. The cows consumed 33.25 lbs. of corn silage per head per day and produced 27.4 lbs. of milk and 1.05 lbs. of butter fat per cow. The average consumption of the stover silage was only 28.31 lbs. per day, while the milk yield averaged 24.5 lbs. and the fat yield 0.98 lb. The cows lost somewhat in weight on both rations, the decrease being greater during corn silage feeding.

The dairy industry in the United States (*La Industria Lechera en los Estados Unidos. Washington: Argentine Embassy, 1921, pp. 216, pls. 16, figs. 6*).—This treatise was prepared for the Sociedad Rural Argentina in connection with an international dairy exposition to be held in May, 1921. Manufacturing processes, the management of milk plants, and the commercial organization of the dairy industry are emphasized. A large number of the publications on dairying issued by the U. S. Department of Agriculture, the standard American treatises on dairying, and the principal dairy magazines published in the United States are listed.

Whole-milk consumption, T. R. Pirtle (*Milk Mag., 8 (1920), No. 3, pp. 5–7, 25, 26, fig. 1*).—This is a summary of available data as to the consumption of milk in various countries of the world.

California dairy products (1919–20), C. F. Hoyt and H. G. Asselstine (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 3 (1921), pp. 54, figs. 11*).—Statistics of the production and manufacture of dairy products in California are presented, with maps showing the distribution of the various dairy industries throughout the State.

Some provisions of California laws on dairying, C. F. Hoyt (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 1 (1920), pp. 10*).—This is a digest of the more important California laws on dairying, and supplements a pamphlet giving the text of the laws, previously noted (E. S. R., 44, p. 75).

Labor used in bottling milk with machines operated by hand levers (*U. S. Dept. Agr., Bur. Anim. Indus., Milk-Plant Letter 86 (1921), pp. 2; also in Milk Dealer, 10 (1921), No. 8, p. 78; Creamery and Milk Plant Mo., 10 (1921), No. 6, p. 53*).—Continuing a previous study of the labor used in bottling milk (E. S. R., 44, p. 574), there are here presented data from 21 milk plants in which the bottles were filled and capped by machines operated with hand lever. An average of 768 bottles were filled and capped per man-hour.

Some important factors in the production of good milk and cream, C. F. Hoyt (*Calif. Dept. Agr., Div. Anim. Indus. Circ. 2 (1920), pp. 15, figs. 8*).—A

survey of the problem of the bacterial contamination of milk with a number of bibliographical references.

Improved technique for the micro or little plate method of counting bacteria in milk, W. D. FROST (*Jour. Infect. Diseases, 28 (1921), No. 2, pp. 176–184, figs. 8*).—For use in the field in making bacterial counts of milk by his little plate method (E. S. R., 36, p. 574), the author describes a portable combination incubator and carrying case for apparatus. The standardized procedure for making the test is given in detail, including some minor modifications which are suggested. It is stated that prolonged incubation (16 to 24 hours) does not affect the count, although a period of only 4 hours is necessary.

Grading milk by the acid test: Influence of acids in the ration on the acidity of milk, H. H. SOMMER and E. B. HART (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 7–11*).—A cow at the Wisconsin Experiment Station was given concentrated sulphuric acid in water mixed with silage and stover for 23 days, the daily dose increasing from 30 to 120 cc. This treatment did not change the titratable acidity, the coagulability by heat, nor the H-ion concentration of the milk, but the urine, which was alkaline (pH=8.21) before acid feeding, became markedly acid (pH as low as 5.83), and the percentage of urinary nitrogen in the form of ammonium salts increased from 0.27 to 6.35. In view of these results with an inorganic acid and those by Turner and Beach (E. S. R., 16, p. 1010) with the organic acids of silage, it is considered improbable that the apparent acidity of milk can be altered by changes in the feed.

Previous work of the authors (E. S. R., 42, p. 208) has shown that milk of high apparent acidity is not necessarily undesirable for condensing purposes. A modification of factory practice in using the acid test is proposed so that normal fresh milk will not be rejected on account of acidity not due to bacterial fermentation.

The relationship between the H-ion concentration and the bacterial content of commercial milk, E. W. SCHULTZ, A. MARX, and H. J. BEAVER (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 1–6, fig. 1*).—The authors have estimated the H-ion concentration of a large number of samples of market milk by colorimetric methods. The counts increased rapidly from about 3,000 per cubic centimeter at pH=6.8 to about 100,000 at pH=6.5, but did not increase much with further increases in acidity. The acidity was not detectable by taste until pH=6. Although definite conclusions are not drawn from this work, it is suggested that further study may make it possible to use the pH values, which can be determined in a few minutes, for estimating the bacterial content of milk.

The acidity of goat's milk in terms of H-ion concentration, with comparisons to that of cow's and human milk, E. W. SCHULTZ and L. R. CHANDLER (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 129–131*).—In 160 determinations of the H-ion concentration in fresh goat's milk, pH varied from 6.7 to 6.4, the average being 6.53. In completely soured milk, pH varied from 4.4 to 3.7 and averaged 3.92. Examination of the literature showed that fresh goat's milk is slightly more acid than fresh cow's milk and appreciably more acid than human breast milk.

The size of fat globules in goat's milk, E. W. SCHULTZ and L. R. CHANDLER (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 133, 134*).—The diameters of the fat globules in 45 samples of goat's milk were measured. The diameter was less than 4 μ in 91 per cent of the fat globules and less than 2 μ in 57 per cent. The measurements tabulated by Bitting (E. S. R., 13, p. 884) showed that over 90 per cent of the fat globules in cow's milk exceeded 4 μ in diameter. "With the quantity of fat practically the same, it becomes obvious that the fat in goat's milk, being more highly dispersed, possesses an enormously greater sur-

face area than does that of either cow's or human milk. It should, therefore, be considerably more accessible to the lipase of the digestive juices, and consequently more rapidly and completely digested."

A study of lactose-fermenting yeasts present in "yeasty" cream, B. W. HAMMER and W. A. CORDES (*Iowa Sta. Research Bul. 61 (1920), pp. 3–24*).—This is a study of the morphological, cultural, and biochemical characters of two lactose-fermenting yeasts, *Torula cremeris* n. sp. and *T. sphaerica* n. sp. The former was isolated from 20 of 21 samples of "yeasty" cream, 7 of 9 samples of No. 2 cream, 11 of 71 samples of clean-flavored sour cream, 2 samples of Iowa milk, a sample of milk from Denmark, and a sample of matzoon originally from Armenia but possibly exposed to infection in the United States. *T. sphaerica* was found in the remaining sample of "yeasty" cream, in 1 sample of No. 2 cream, and in 1 sample of clean-flavored cream. In no case were the two species found together. *T. cremoris* is the larger and was usually oval in form.

These yeasts were found to grow readily in milk and in sweet cream, but produced the characteristic foaming only in cream that was more or less coagulated.

Sandiness in ice cream (*Indiana Sta. Rpt. 1920, p. 18*).—It is stated that experiments at the station warrant the conclusion that sandiness in ice cream is due to the precipitation of milk sugar after the freezing process is completed. The defect can be controlled to some extent by keeping the proportion of milk solids in the mix below 10 or 12 per cent, and also by using particular combinations (not specified) of gums, gelatin, and coagulants.

VETERINARY MEDICINE.

Textbook of special pathology and therapy of domestic animals, E. FRÖHNER and W. ZWICK (*Lehrbuch der Speziellen Pathologie und Therapie der Haustiere. Stuttgart: Ferdinand Enke, 8. rev. ed., vol. 2, 1919, pt. 1, pp. XVI+655, figs. 180; 1920, pt. 2, pp. XI+623, pls. 3, figs. 182*).—This volume of the new edition, volume 1 of which has been previously noted (E. S. R., 36, p. 478), is a continuation of the account on infectious diseases. Included at the end is a classified bibliography of 133 pages, relating to the infectious diseases dealt with in the two parts of volume 2. The plates and many of the figures are in colors.

Outlines of clinical diagnosis of internal diseases of domestic animals, B. MALKMUS (*Grundriss der Klinischen Diagnostik der Inneren Krankheiten der Haustiere. Leipzig: Max Jänecke, 1920, 8 and 9. ed., pp. VII+232, figs. 67*).—A new edition of this work, of which the English translation of the fourth edition has been previously noted (E. S. R., 27, p. 77).

Haubner's veterinary medicine for the agriculturist, edited by O. RÖDER (*Haubner's Landwirtschaftliche Tierheilkunde. Berlin: P. Parey, 1920, 18. rev. ed., pp. XII+783, figs. 165*).—This is the eighteenth revised edition of the work previously noted (E. S. R., 26, p. 578).

[Report of the department of] veterinary science (*Indiana Sta. Rpt. 1920, pp. 43–47*).—Hog cholera feeding experiments failed to demonstrate the presence of the virus in the urine and feces of hogs having acute cholera. In infection experiments, healthy controls, separated from pigs inoculated with cholera blood by wire partitions placed 3 ft. apart, contracted the disease in from 17 to 23 days. Numerous attempts made to isolate *Bacillus suipestifer* from the feces of hogs affected with cholera and dysentery proved unsuccessful. Pigs that were fed cultures of *B. suipestifer* sickened and developed diarrhea, but

in no case was *B. suipestifer* recovered from the feces, although an organism somewhat resembling it was constantly isolated. The administration of thymol-chenopodium in capsules failed to prove of value in removal of intestinal worms.

In an outbreak of a disease in horses that resembled forage poisoning, in which 16 of 32 horses on a farm died between February 15 and March 2, an organism morphologically similar to *B. botulinus* was obtained from the caecum of one horse, but it did not produce toxin. Botulinus antitoxin of the B type was administered subcutaneously in doses of 40 to 80 cc., repeated in two days, but did not seem to prevent the disease or retard its progress.

The preparation of chicken-pox vaccine was begun early in the year, 1,286 birds in six flocks being tested with satisfactory results. A summary is given of the laboratory diagnoses made during the year, and reference is made to the production of antihog-cholera serum and serum tests and to agglutination and bacterin tests.

Work of the live stock sanitary board, W. A. McRae (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pp. 23–39, figs. 5*).—This report deals particularly with tick eradication and hog cholera control work.

Biennial report of the State veterinarian of the State of Wyoming, B. F. Davis (*Wyo. State Vet. Bien. Rpt., 1918–20, pp. 31*).—Work with infectious diseases from September 30, 1918, to September 30, 1920, is reported upon, particular attention being given to tuberculosis and its eradication through the accredited-herd plan.

[Report of the] veterinary division, S. Youngberg ([*Philippine*] *Bur. Agr. Ann. Rpt., 1919, pp. 26–36, pls. 5*).—This report deals particularly with control work with rinderpest, of which there were 16,228 new cases during the year and 11,085 deaths recorded. During the year a total of 6,467 cents and carabaos were immunized against rinderpest.

Annual reports of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., for the years 1917, 1918, and 1919, A. W. Anstruther and S. Stockman (*Bd. Agr. and Fisheries* [*London*], [*Vet. Dept.*], *Ann. Rpts. Proc. 1917, pp. 26; 1918, pp. 30; Min. Agr. and Fisheries* [*London*], [*Vet. Dept.*], *Ann. Rpts. Proc. 1919, pp. 74, fig. 1*).—These are the usual annual reports on the occurence of and work with infectious diseases and parasites of live stock (E. S. R., 37, p. 779). The outbreaks and control work with foot-and-mouth disease are discussed at considerable length in the report for the year 1919.

Annual report of the civil veterinary department, Bihar and Orissa, for the year 1919–20, D. Quinlan (*Bihar and Orissa Civ. Vet. Dept. Ann. Rpt., 1919–20, pp. [4]+8+XIV+2, pl. 1*).—This is the usual annual report (E. S. R., 42, p. 675).

Further observations on the standardization of bacterial suspensions, H. C. Brown (*Indian Jour. Med. Research, 7 (1919), No. 1, pp. 238–250*).—Attention is called to the discrepancy in the results obtained when using different recognized methods for estimating the number of organisms in a bacterial suspension, and a further description is given of a method previously recommended by Brown and Kirwan[3] of standardization by means of opacity tubes. This consists in a comparison of a suspension of the organism with standard suspensions of barium hydroxid.

A series of observations is reported showing that the opacity of a bacterial suspension is proportional to the weight of dried bacterial protoplasm contained in it. A table is also given showing the relation of opacity to the weight

[3] Indian Jour. Med. Research, 2 (1915), No. 3, pp. 763–769.

and numerical equivalents of various bacteria. The technique of preparing the standard tubes and of standardizing and preparing actual doses of vaccines by this method is described in detail.

Preservation of stock cultures of bacteria by freezing and drying, H. F. SWIFT (*Jour. Expt. Med., 33 (1921), No. 1, pp. 69–75, fig. 1*).—Experience with the method of preserving stock cultures of bacteria by freezing and drying has shown that the viability of the organisms can be correlated with the physical state of the dried material, and that success with this method depends upon maintaining a frozen state until drying is complete. This has been accomplished in the method described by immersing the tubes containing the frozen culture in glycerin in a vacuum desiccator surrounded by salt and ice. After the proper degree of vacuum has been obtained the whole apparatus is placed in the ice box and left for about 12 hours, or until desiccation is complete, after which the tubes are removed from the desiccator, the cotton stoppers pushed down, and the tops sealed with melted paraffin. The properly dried culture is said to be very light and spongy, resembling dried lather from shaving soap.

Magnesium sulphate in arsenic poisoning, O. S. HANSEN (*Jour. Pharmacol. and Expt. Ther., 17 (1921), No. 2, pp. 105–113, fig. 1*).—While definite conclusions can not be drawn regarding the action of magnesium sulphate in arsenic poisoning, the author's work has led to the following summary:

"Magnesium sulphate has prolonged the average life of a series of 50 rabbits poisoned by arsenic from 219 hours to 415 hours on the average, but can not be said to have saved life in rabbits. Magnesium sulphate is toxic in large doses and to some extent in medium-sized doses. There is a marked variation of individual susceptibility to arsenic poisoning."

Poisonous properties of the whorled milkweeds Asclepias pumila and A. verticillata geyeri, C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr. Bul. 942 (1921), pp. 14, pls. 3, figs. 2*).—The species of milkweed here considered, which have been found to possess poisonous properties, are closely related to the whorled milkweed (*A. galioides*), a bulletin relating to which has been noted (E. S. R., 43, p. 470). The present bulletin summarizes the results of experimental work on these two milkweeds. The work has shown *A. pumila* to be about one-third as toxic as the very poisonous *A. galioides*, and *A. verticillata geyeri* about one-tenth as toxic as *A. galioides*.

A. pumila, the low whorled milkweed, is found in adobe draws, in dry plains, and in foothills from southeastern Montana and southwestern North Dakota to the Texas Panhandle and central New Mexico, being most abundant on the plains of Colorado. It is usually scattered in small patches in draws. In feeding experiments, the smallest quantity which produced intoxication was 0.787 lb. per 100 lbs of animal, and the smallest quantity that produced death 2.165 lbs. per 100 lbs. of animal. The most prominent symptom in all the cases of poisoning was a weakness of the hind quarters of the animals, which resulted in a staggering gait. There was in most of the cases depression and in some evident trembling, but the staggering was universally present and was particularly noticeable. The pulse generally was weak and rapid, and the animals which were quite sick frequently accompanied the expirations with a grunt or a groan. In the cases which recovered there was no bloating, salivation, or spasm. In the animals which were fatally poisoned, in addition to the symptoms mentioned, there was some bloating and salivation, and they exhibited violent spasms, accompanied with running movements. In two fatal cases the temperature of the sheep reached a maximum of 107 and 109.6° F., respectively. The symptoms continued from a minimum of 7.5 hours to a maximum of 5 days. Of the two animals that died, death followed in 32 and 38 hours, respectively.

A. verticillata, the whorled milkweed of the eastern part of the United States, is distributed throughout the Atlantic Plains and the Mississippi Valley. It differs materially from *A. galioides*, *A. pumila*, and *A. mexicana* in that it has long, fibrous roots and smooth pods. *A. verticillata geyeri* can be distinguished from the typical form by its numerous adventitious buds on the fibrous roots. In feeding experiments with 10 sheep, 2.205 lbs. of leaves and stems was found to be very close to the toxic dose. With the leaves alone 1.286 lbs. was a toxic dose. In the very sick sheep "all the typical symptoms of *A. galioides* were noted, including weakness, especially marked in the hind legs, staggering, weak and rapid pulse, labored respiration (the expirations accompanied with groans), dilated pupils, elevated temperature, bloating, spasms with opisthotonos, and running movements. Spasmodic movements of the mandibles in a chewing movement were very noticeable." The average time before the symptoms appeared was 16 hours 47 minutes, and the average duration of the symptoms was 4.5 and 4.75 hours, with a minimum of 1 hour and a maximum of 11 hours.

It is pointed out that, while as stock-poisoning plants these two species have no history, there is reason to believe that if grazing animals were closely confined to them, injurious results would follow.

Poisoning of cattle by feeding on ergotized paspalum, D. T. Mitchell (*Feedingstuffs, 38 (1921), No. 3, pp. 46, 47, 49*).—This paper reports on the loss caused in the Province of Natal by feeding on grasses infected by a fungus identified by I. B. P. Evans as *Claviceps paspali*.

Hydrocyanic acid in Sudan grass and its effect on cattle, C. O. Swanson (*Jour. Amer. Soc. Agron., 13 (1921), No. 1, pp. 33–36*).—This preliminary report of work at the Kansas Experiment Station is summarized as follows:

"Hydrocyanic acid was found in large amounts in Sudan grass used for pasture, and no harm resulted to the cattle. Liberation of hydrocyanic acid from Sudan grass is apparently associated with enzym action. Digesting in water at room temperature for several hours and then distilling gave larger amounts of hydrocyanic acid than if sulphuric acid was added at once. Hot water and dry heat diminished the amount of hydrocyanic acid obtained. Slow drying caused the hydrocyanic acid to disappear. Tests made on wilted samples or those several days old may be worthless.

"Making Sudan grass into silage did not diminish the amount of hydrocyanic acid obtained. Tests made immediately on frosted Sudan grass gave very large amounts of hydrocyanic acid, but it disappeared rapidly as soon as the plant began to wilt; when dry the hydrocyanic acid had disappeared. While Sudan grass giving a strong test for hydrocyanic acid was not harmful to cattle, under other conditions it was harmful. Immunity was not due to habituation."

Epizootic abortion, V. Robin (*Rev. Vét. [Toulouse], 73 (1921), Nos. 1, pp. 1–17; 2, pp. 65–76*).—This is a general review of the subject as related to the cow, horse, sheep, and pig, discussed in connection with references to the literature.

Researches on infectious abortion in mares, M. Carpano (*Ann. Ig. [Rome], 29 (1919), No. 11, pp. 752–779*).—The author reviews the literature on infectious abortion in mares and joint-ill or arthritis in foals and reports the results of his study of this disease in Italy, where abortions in mares, particularly the imported stock, are quite common and the foals born alive in localities where abortions have occurred are often affected with polyarthritis.

Two microorganisms have been isolated from pathological cases, *Bacillus abortus equi* and a micrococcus of the type of *Streptococcus equi*, the former being considered the causative agent. The characteristics of these organisms

are described and successful experiments are reported on the diagnosis of the disease by serum agglutination and on the therapeutic and prophylactic treatment of the disease with a mixed polyvalent serum.

Further studies on the etiological rôle of Vibrio fetus, T. SMITH, R. B. LITTLE, and M. S. TAYLOR (*Jour. Expt. Med., 32 (1920), No. 6, pp. 683–689*).—Previous studies on the etiological rôle of *V. fetus* (E. S. R., 41, p. 779) are supplemented by the reports of three cases of abortion among native heifers, in which the absence of *Bacillus abortus* and the presence of *V. fetus* were definitely proved.

The peculiar distribution of abortions due to *V. fetus*, first among older cows and later in the young stock in the herd studied, is attributed to the fact that the heifers during the first pregnancy were segregated from the purchased cows and were thus kept away from the Vibrio carriers until after the first calving. The fact that the number of cases of vibrionic abortion declined during a period in which cases due to *B. abortus* continued undiminished is thought to indicate that natural immunization of a herd to *V. fetus* proceeds quite rapidly. "Another outbreak may be expected when the immunity of the herd has declined in the absence of the infecting agent and the latter is reintroduced from without, or it may reappear at any time when a Vibrio of higher virulence is brought in."

Experience with the Ascoli precipitin reaction for the detection of anthrax, R. REINHARDT (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 5–6, pp. 268–275*).—A study is reported of the comparative value of microscopic investigation, cultural methods, animal inoculation, and the precipitin reaction of Ascoli (E. S. R., 26, p. 375) for the detection of anthrax in animal carcasses. The results reported are thought to indicate the superiority of the precipitin test, particularly in the detection of anthrax in badly decomposed material.

Immunization against blackleg with germ-free filtrates, E. GRÄUB and W. ZSCHOKKE (*Schweiz. Arch. Tierheilk., 62 (1920), Nos. 2, pp. 52–65; 3, pp. 112–122*).—From a series of experiments on the immunization of guinea pigs, sheep, and cattle against blackleg, the authors conclude that a single subcutaneous injection of blackleg filtrate produces an immunity which protects the animals against double the ordinary fatal dose of virulent blackleg material. A second inoculation with attenuated virus which is not fatal to normal animals, but in itself produces only slight immunity, greatly increases the immunity produced by the filtrate. It is considered that the immunity is not only active and lasting against the strain used for the preparation of the filtrate but against other strains as well.

In practice, the single immunization with blackleg filtrate is recommended for cattle which are exposed to blackleg infection only during the pasture season and the double method for animals continually exposed to infection. Inoculation with the virus should be given not earlier than 10 days nor later than two months after the filtrate inoculation.

Chemotherapy and chemoprophylaxis of foot-and-mouth disease, P. SERENA and F. KUONI (*Schweiz. Arch. Tierheilk., 62 (1920), No. 2, pp. 65–73; abs. in Rev. Gén. Méd. Vét., 29 (1920), No. 341, pp. 259–261*).—The authors report an extensive series of studies on the effect of trypan blue on foot-and-mouth disease in various stages of its development. From 2.5 to 16 gm. of the dye dissolved in from 200 to 400 gm. of boiled water was injected subcutaneously into the side of the neck. The absorption of the dye took place rapidly, and the color persisted for some time at the site of the injection.

The effects of trypan blue upon animals with clinical symptoms are said to be very marked, including rapid lowering of temperature, disappearance of local lesions, and cicatrization of ruptured vesicles. In animals with high fever, but showing no local symptoms, the results were also very striking, local lesions

seldom appearing. The authors are of the opinion that chemotherapy is destined to play a considerable rôle in the struggle against foot-and-mouth disease.

The measures taken by Switzerland in recent years for the control of foot-and-mouth disease, L. PLANISSET (*Rev. Gén. Méd. Vét., 30 (1921), No, 349, pp. 1–12*).—This is a brief account in which control measures are considered under the headings of general slaughter, sanitary measures, and treatment with blood of animals recovered from the disease.

Observations on the intrapalpebral test for glanders, W. F. GUARD (*Vet. Alumni Quart. [Ohio State Univ.], 8 (1920), No. 2, pp. 45–51*).—The author discusses the intrapalpebral test for glanders from experience in its use in the American Expeditionary Forces from June, 1918, to May, 1919. The rules adopted in February, 1919, for the application and interpretation of the test are given in full, together with a table representing what was finally considered a fair and practical guide for interpreting the test.

Statistics are given of the number of animals tested and the number of reactors found during certain periods in all the organizations of the Third Army and of the report of the First Division alone during this period. These statistics show a decided falling off in the number of reactions after the second test and the total disappearance of the disease after 3 or 4 weeks. While the animals were tested every 20 or 30 days, the author is of the opinion that the elimination of the infection would be hastened by repeating the test at 10-day intervals.

Rinderpest in Belgium (*Rev. Gén. Méd. Vét., 29 (1920), No. 347, pp. 577–583*).—This is an account of the introduction of rinderpest into and its occurrence in Belgium, reference to which has been previously noted (E. S. R., 44, p. 680).

Bacillary infection and tuberculosis in man and in animals, A. CALMETTE (*L'Infection Bacillaire et la Tuberculose chez l'Homme et chez les Animaux. Paris: Masson & Co., 1920, pp. VI+619, pls. 25, figs. 31*).—The author of this very complete treatise on tuberculosis states that it has been his aim to disengage from the more important of the large number of contributions to this subject and from his own researches, covering a period of many years, the scientific principles upon which must be based the struggle against tuberculosis. The first part, following a brief historical introduction, deals with the general phases of tubercular processes, including the morphology, culture, isolation, and chemical constitution of the tubercle bacillus and the influence of physical and chemical agents upon it, tuberculins, histogenesis, and evolution of the tubercle and bacillary lesions without tuberculous follicles, principal anatomical-pathological types of infection, mechanism of infections through various routes, characteristics of the disease in young and old and in various localizations, and rôle of heredity in the transmission of the disease.

Part 2 deals with experimental tuberculosis and tuberculosis infection in animals, including chapters on different methods of experimental inoculation and infection, differential characteristics of the human and bovine types of tuberculosis, the special characteristics, frequency, and geographical distribution of bovine tuberculosis, specific reactions for its diagnosis, the rôle of bovine tuberculosis in the question of human infection, tuberculous infection in other mammals, in birds, and in cold-blooded animals, and a final chapter on pseudo or paratuberculous acid-resistant bacilli. In part 3 the author discusses the various processes of defense of the organisms against tuberculous infection and the diagnosis of the disease by examination of excretions and by various modifications of the tuberculin reaction.

The fourth and final part deals with natural immunity and the processes of immunization against tuberculous infection. In the concluding chapter, on the

scientific principles which must serve as the basis of antituberculous prophylaxis, the author states that in his opinion the only hope of limiting and finally exterminating the disease is in the vaccination of all susceptible human beings and animals by some such method of the use of attenuated bacilli as has been previously tested with animals (E. S. R., 44, p. 780).

The book is profusely illustrated throughout with colored plates of tuberculous lesions both in man and in animals.

The nodular worm and the lesions caused by it (Oesophagostomum columbianum Curt.), A. THEILER (*Union So. Africa, Dept. Agr. Jour., 2 (1921), No. 1, pp. 44–51, figs. 2*).—An account of this worm and its injury to lambs and sheep in South Africa.

Studies on the sheep stomach worm, Haemonchus contortus, J. E. GUBERLET (*Abs. in Anat. Rec., 20 (1921), No. 2, p. 209*).—In studies conducted at the Oklahoma Experiment Station several hundred sheep were treated for the removal of stomach worms. "Copper sulphate in a 1 per cent solution, at the rate of 50 cc. for lambs under one year and 100 cc. for sheep over one year, was found to be 75 to 95 per cent effective. A solution containing 1 per cent copper sulphate and 1 per cent tobacco infusion was found to have an efficiency of 90 to 100 per cent. Cacodylate of sodium was injected intramuscularly at the rate of 7 grains for an adult sheep. Two or three injections were made at intervals of two or three days with only negative results."

It is pointed out that "an estimate can be made of the number of stomach worms in the host from the number of eggs in the droppings. Under normal conditions the number of eggs in a gram of fresh droppings corresponds fairly well with the number of adult female worms in the host. There seems to be from one and one-half to two times as many females as males. Hence, the number of eggs in a gram of fresh droppings, plus one-half to one times that number, gives a fair estimate of the number of adult worms in the host."

Swine practice, A. T. KINSLEY (*Chicago: Amer. Vet. Pub. Co., 1921, pp. 374, pls. 4, figs. 111*).—This is a revised and enlarged edition of the author's Swine Diseases, previously noted (E. S. R., 32, p. 378).

A blackleg- and bradsot-like disease of swine, J. KÖVES (*Centbl. Bakt. [etc.], 1. Abt., Orig., 80 (1917), No. 1–3, pp. 40–65, pls. 5*).—This is a contribution from the bacteriological laboratory of the hog cholera serum plant at Budapest, where a study has been made of the types of anaerobic spore-bearing bacteria occurring in swine. The details are given of studies of the morphology and cultural characteristics of anaerobes obtained from 26 hogs during a period of five years. The diseased conditions present in these animals are recognized by the author as falling into two groups, (1) those found in subcutaneous or muscle tissues, which resemble lesions occurring in blackleg disease in cattle, and (2) those in which the lesions are localized in the stomach, resembling the bradsot disease of sheep. An anaerobic spore-producing organism, isolated from all the cases, was compared with the blackleg bacillus, the malignant edema bacillus, and the Ghon Sachs baccillus.

A list is given of 29 references to the literature.

Effects of X-rays on trichinae, B. SCHWARTZ (*Jour. Agr. Research [U. S.], 20 (1921), No. 11, pp. 845–854*).—Five series of experiments conducted with a view to determine whether X-rays exert deleterious influences on *Trichinella spiralis*, with a further view to the practical application of X-ray radiation to the destruction of trichinae in pork are reported upon. The results are summarized as follows:

"Encysted trichinae are injured by relatively heavy dosages of X-rays. So far as has been determined, the injuries are not visible in the encysted or artificially decapsuled larvae as structural or functional disturbances, but

become apparent only when the larvae reach a suitable host animal in whose intestine they are normally capable of continuing their development. Trichinae from meat that has been exposed to strong dosages of X-rays undergo rapid granular degeneration in the intestines of suitable hosts before they attain maturity.

"Encysted larvae that have been exposed to lower but still injurious dosages of X-rays are able to continue development in the intestines of suitable hosts. Such larvae, however, do not attain structural and functional sex maturity. The sex cells appear to be atrophied, and no evidence of successful copulation can be found. X-rays, therefore, appear to exert a more or less selective action on the gonads of trichinae.

"Trichinae appear to exhibit considerable variation in their susceptibility to X-rays, since certain dosages injured some parasites and failed to injure others. Whether the apparent variation in susceptibility of trichinae to X-rays is an expression of an actual physiological variation or may be accounted for by other factors has not been determined.

"The experiments described in this paper do not warrant any definite conclusions as to the feasibility of using X-ray radiation as a practical means of destroying trichinae in pork."

An epizootic of fowl typhoid in France, F. D'HERELLE (*Rev. Gén. Méd. Vét., 29 (1920), No. 339, pp. 128–130; abs. in Jour. Compar. Path. and Ther., 33 (1920), No. 3, p. 215*).—The loss occasioned during a series of widespread outbreaks of disease among poultry in France was in a great majority of cases due to fowl typhoid (*Bacterium sanguinarum*), the existence of which had not previously been reported in that country. It is said that in certain places there occurs in coexistence with fowl typhoid another disease of undetermined etiology which causes a high mortality among fowl and geese, the latter of which are not susceptible to fowl typhoid.

Common chick diseases, W. T. JOHNSON (*Washington Sta., West Wash. Sta. Mo. Bul., 9 (1921), No. 1, pp. 11–14*).—This is a popular summary of information on the subject. The author considers 20 per cent loss up to the time of laying, or about five or six months of age, to be a conservative estimate.

Babesia canis and Haemogregarina canis in the south of France, E. PRINGAULT (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 33, p. 1444*).—In the course of investigations of canine leishmaniosis the author has met with *B. canis* and *H. canis* in the blood of dogs. In examinations of 367 dogs from 1913 to 1917, 5.88 per cent were parasitized by *B. canis* and 0.81 per cent by *H. canis*. Canine piroplasmosis was found to be most frequent in summer when it averaged 2.23 per cent, and lowest in winter when it reached an average of 0.56 per cent. *H. canis* was observed three times, twice in July and once in August.

Some common parasitic worms occurring in the domesticated animals in South Africa, E. M. ROBINSON (*So. African Jour. Nat. Hist., 2 (1920), No. 2, pp. 277–279*).—This is a brief account of some of the more important endoparasites of domestic animals.

RURAL ENGINEERING.

Nineteenth annual report of the Reclamation Service, 1919–20, A. P. DAVIS (*[U. S.] Reclam. Serv. Ann. Rpt., 19 (1920), pp. 589, fig. 1*).—This report relates in particular to the work completed and in progress during the fiscal year ended June 30, 1920, and also contains information in regard to previous operations for explanatory purposes and to indicate progress.

On June 30, 1920, the net cost of construction of the reclamation projects amounted to a little less than $125,000,000. The value of crops grown in 1919 on

lands served either in whole or in part from the works of the service amounted to nearly $153,000,000, about $89,000,000 of which represents the value of crops grown on the 1,113,469 acres of cropped land on the projects proper, from which definite crop statistics are secured, or $79.88 per acre, and the balance an estimated amount from approximately 1,000,000 acres of land served with water under the Warren Act from the works of the service. The projects already completed or under way will ultimately comprise an area of over 3,300,000 acres.

Review of the work of the irrigation department, Central Provinces, for the year 1919–20, S. G. RIVETT-CARNAC (*Cent. Provs. [and Berar, India], Irrig. Dept. Rev., 1919–20, pp. [1]+15*).—This report deals with the work and expenditures of the irrigation department of the Central Provinces of India for the fiscal year 1919–20.

Factors determining the duty of water in irrigation, J. T. KINGDON (*Engin. News-Rec., 86 (1921), No. 13, pp. 546, 547*).—A list of the various and interrelated factors determining the use of water in irrigation is given, which has been prepared for use in court cases. It is considered useful as a guide in the analysis of conditions on new projects and for the improvement of conditions on projects already in operation.

Surface water supply of New Mexico, 1919–1920, L. A. GILLETT (*Santa Fe, N. Mex.: State Engin. Dept., 1919–20, pp. 184*).—This report presents the results of measurements of flow made on streams in New Mexico during the calendar year 1919 and up to and including September 30, 1920. Data on evaporation from water surfaces are also included.

Farm drainage for larger and better crops, H. B. ROE and G. R. B. ELLIOTT (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 61–90, figs. 32*).—A large amount of practical information on land drainage as it is practiced in the State of Minnesota is given, as a contribution from the University of Minnesota.

Power applied to agriculture.—II, Water power, W. H. S. CLEGHORNE (*So. African Jour. Indus., 3 (1920), No. 7, pp. 588–596, pl. 1, figs. 4*).—In a second contribution to the subject (E. S. R., 43, p. 591), the author deals with the development of water power for farm use, describes the overshot wheel, the Francis turbine, and the Pelton wheel, and also deals with pipe lines and supply dams.

Investigations of road subgrades, A. T. GOLDBECK (*Jour. Soc. Automotive Engin., 8 (1921), No. 4, pp. 339–346, figs. 7*).—A review is given of work finished and in progress on the investigation of road subgrades, especially that conducted by the Bureau of Public Roads of the U. S. Department of Agriculture.

Biennial report of the Department of Highways, 1919–1920, J. M. LEONARD ET AL. (*Nev. State Dept. Highways Bien. Rpt., 1919–20, pp. 144, figs. 51*).—Data on the work and expenditures of the Nevada Department of Highways on the construction of the State highway system for the period from January 1, 1919, to November 30, 1920, are contained in this report.

Fourth biennial report of the Oregon State Highway Commission covering the period December 1, 1918, to November 30, 1920, R. A. BOOTH ET AL. (*Oreg. State Highway Comm. Bien. Rpt., 4 (1918–1920), pp. IV+425, pls. 49*).—Data on the work and expenditures of the Oregon State Highway Commission and of the office of the State highway engineer for the biennium ended November 30, 1920, are contained in this report.

Dust explosions: Cause, effect, and prevention, D. J. PRICE (*Engin. News-Rec., 86 (1921), No. 15, pp. 634–636, figs. 3*).—A brief review is given of some of the work of the U. S. Department of Agriculture on the cause, effect, and prevention of dust explosions.

Ignition temperatures resulting in explosion were determined as 2,363° F. for wheat elevator dust, 2,300° for flour, 1,821° for oats and corn elevator dust, 1,868° for oats hull dust, and 1,877° for yellow corn dust. Limited tests indi-

cate that the velocity through a cloud of wheat flour dust is practically the same as through coal dust, and that through a cloud of powdered starch it is several times as rapid.

Tests conducted in cooperation with the U. S. Bureau of Mines showed that the following explosion pressures in pounds per square inch were developed: Lycopodium 17.5, wheat smut dust 15.9, yellow corn 15.2, dextrin 14.6, tan bark 13.3, wheat elevator dust 13, wood dust 12.8, corn starch 12.7, sugar 12.2, potato flour 11.7, fertilizer 10.5, coal (Pittsburgh) 10.1, cocoa 9.1, sulphur 8.8, and cork 7.4. From the know chemical composition of flour and a calculation of the approximate mechanical work which a given mass of flour can perform, it has been found that the contents of an ordinary sack, when mixed with 4,000 cu. ft. of air, will generate force enough to throw 2,500 tons mass to a height of 100 ft.

It is considered reasonable to conclude that the dust explosion hazard is greater during periods of continued low humidity. Possible changes in construction and the installation of mechanical equipment suggested by recent explosions are discussed. Among these, the prevention of the generation of high pressures by the use of thin walls offering little resistance to explosion pressures is suggested.

The kiln drying of lumber, H. D. TIEMANN (*Philadelphia and London: J. B. Lippincott Co., 1920, 3. ed., pp. XI+318, pls. 31, figs. 40*).—This is the third edition of this book (E. S. R., 38, p. 46).

The carburetion of alcohol, A. W. SCARRATT (*Jour. Soc. Automotive Engin., 8 (1921), No. 4, pp. 328–330, figs. 2*).—The results of experimental work in the development of a tractor engine that will burn alcohol are reported.

Using a 4¼ by 6 in., 4-cylinder, 16-valve engine, it was found that the best compression was 110 lbs. per square inch. The use of the entire exhaust heat for heating the fuel charge was found to be necessary. The temperature of the ingoing charge of fuel for good carburetion and economical operation should not be less than 100° F. The intake-manifold should be designed to obtain uniform distribution, and the intake-manifold gas velocity at full load should not be less than 9,500 ft. per minute on the average.

Starting difficulties were increased when burning alcohol, but satisfactory starting was accomplished by a redesign of the starting crank, together with the use of a mixture of four parts of alcohol to one of gasoline.

Belgian experiments on palm oil as motor fuel (*Chem. and Metall. Engin., 24 (1921), No. 9, pp. 400, 401*).—A series of experiments begun in 1914 and now in progress on the use of palm oil as a fuel for internal-combustion engines is briefly described.

It is stated that the calorific power of palm oil is from 20 to 25 per cent less than that of crude oil, and that it fuses at a comparatively high temperature (37° C.). Complete combustion was found to be necessary to the satisfactory utilization of palm oil. After starting and warming up on crude oil several engines ran smoothly on palm oil. The oil neither clogged the motors nor left any perceptible solid residue.

Analyses are said to show that palm oil is a mixture of palmitate and oleate of glycerin, with some variable quantities of palmitic and oleic acid. It contains about 95 per cent of fatty acids and appears as a pasty substance of yellowish or salmon color. Its calorific power is estimated at 9,228 calories, and it is flammable at 210°.

The Nebraska tractor tests, O. W. SJOGREN ET AL. (*Nebraska Sta. Bul. 177 (1921), pp. 14, fig. 1*).—This bulletin enumerates the provisions and objects of the Nebraska tractor testing law (E. S. R., 42, p. 784), describes the tests imposed and the apparatus used, and summarizes the data contained in the re-

ports of tests conducted in 1920. The tests covered 69 different tractors of about 38 makes. Some of the details of these tests have been noted in the *Record* from time to time.

Farm mechanics (*Indiana Sta. Rpt. 1920, p. 24*).—Tractor tests to determine actual ratings showed that the angle iron cleat wheel equipment commonly used permitted as high as 40 per cent slippage on a 2 plow tractor between normal and no load. In dry soil the sequence of cuts made by the angles resulted in a series of earth blocks cut loose, which moved back when the thrust of the tractor came against them. The disturbance of the soil was extreme, causing unnecessary strains to be thrown on the mechanism of the tractor by constant jerking. The effects of the angles were not nearly so pronounced on damp plastic soil.

Best results were obtained with a thin spade about 3 in. square. Only 3 per cent slippage was observed with these. The conclusion is drawn that the best type of lug is that which enters and leaves the ground with the least disturbance. The staggered spade lug was the best in this respect.

How the tractor saves time, C. H. Sprague (*Tractor and Gas Engine Rev., 14 (1921), No. 3, pp. 7, 49, figs. 3*).—Graphic data are presented on the time required to plow, till, plant, and harvest 30 acres of wheat with a tractor and with horses. It is shown that about one-fourth the time was necessary to do the work by tractor as by horses, and it is pointed out that the tractor because of its extra power was able to plow deeper and make a better seed bed.

I, Working tests of straw presses, packers, and carriers. II, Individual and new tests, and other investigations, A. Christensen (*Statens Redsk. Prøver, Beret. 21 (1919), pp. 91, figs. 23*).—Comparative tests of 10 different commercial makes of straw presses, packers, cutters, and carriers are reported and discussed, together with special individual tests of different apparatus, such as a potato digger, lubricators, paper-binding twine, and different commercial makes of farm engines and motor plows.

Studies on corn-harvesting machinery, M. Conti (*Rev. Facult. Agron. y Vet., Buenos Aires, 3 (1920), No. 1, pp. 25–32, figs. 4*).—Two corn harvesters developed after three years' study at the Experimental Institute of Agricultural Mechanics at Buenos Aires are described.

One machine is adapted for the cutting of green corn for silage, and consists of an inclined knife between forked iron frame parts which receive and cut the standing corn, allowing it to fall on a platform where it is properly loaded. Two men and three horses are required.

The second machine is adapted for the harvesting of dry corn and also requires two men and three horses. The knife is a circular saw-edged type, revolving at between 180 and 200 r. p. m., and is actuated by a wheel on the ground. Both machines are said to have been satisfactory under test.

The twist drill: Making it fulfill great expectations, H. Wills (*Tractor and Gas Engine Rev., 14 (1921), No. 3, pp. 10, 11, 43, figs. 14*).—Data and information on the proper use and maintenance of twist drills, with particular reference to the repair of farm machinery, are given.

Farm buildings, F. C. Lewis (*Indiana Sta. Circ. 100 (1921), pp. 144, figs. 130*).—The purpose of this circular is to offer suggestions on the planning and construction of farm buildings, including dwellings, barns, hog and poultry houses, workshops, and other buildings. It is based upon a study of farm-building practice in Indiana and neighboring States. Plan and detail drawings of the different structures are given, together with considerable working data.

Domestic architecture, L. E. Robinson (*New York: Macmillan Co., 1917, pp. XIII+378, figs. 50*).—Part 1 of this book is a text intended for use in teaching

the subject of the house in colleges and in schools of home economics. It is devoted to a consideration of house design and construction, the cost of dwellings, and such related topics as the selection and development of the site, and, to some extent, of the equipment and decoration of the interior. Chapters are included on the history of domestic architecture, domestic architecture in the United States, and the practice of architecture. Sketch problems are appended to each chapter.

Part 2 is a practical guide for house design, consisting of a drafting-room manual, problems in design, and a glossary of architectural terms.

Conveniences in the home, J. L. SHEPPERD (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 138–148, figs. 11*).—General drawings and practical information are given for installing what are considered to be cheap and serviceable water-supply systems for farm homes. These include also information on cisterns.

The septic tank—a method of sewage disposal for the isolated home, H. E. MURDOCK (*Montana Sta. Bul. 137 (1920), pp. 27, figs. 14*).—A progress report is presented on studies begun in 1915 at the station with three different types of sewage-treatment tanks and disposal areas, together with general information regarding results obtained from miscellaneous installations in the neighborhood.

The tanks included (1) a single-chamber septic tank 3 ft. wide, 7 ft. 10 in. long, and 3 ft. deep; (2) a double-chamber septic tank with digestion chamber 2 ft. wide, 5 ft. long, and 4½ ft. deep, and a discharge chamber fitted with an automatic siphon; and (3) a modified Imhoff tank 3 ft. 4 in. wide, 4 ft. 4 in. long, and 14 ft. deep at one side and 16 ft. deep at the other. All three tanks are provided with sludge outlets and with inlets entering below the sewage line. No definite data are given regarding the nature and amount of the sewage treated or the basis of design of the tanks. However, it is noted that during four winter seasons the sewage flow to the tank varied widely in nature and amount and was discontinued for considerable periods from time to time.

After the four seasons it was found that approximately the same amount of scum was on the surface of each tank. It appeared that the septic action and the deposition of sludge were practically the same in the three tanks. There was very little sludge deposition, and apparently septic action was good in all three tanks in spite of the variable conditions of service imposed.

The disposal areas were operated at a depth of 14 in. in light soil and were apparently little hindered by long periods of zero weather. They cared for the sewage effluent satisfactorily.

On account of the simplicity, ease of construction, and comparatively low cost of the single-chamber tank it is recommended for isolated homes.

The studies are being continued.

Surface purification of sewage, W. D. SCOULLER (*Surveyor and Munic. and County Engin., 58 (1920), No. 1511, pp. 447, 448*).—Studies on the various stages in the purification of sewage passing through a percolating filter are reported. An inclined galvanized tube 8 ft. long and 6 in. in diameter, containing 1 in. clinker obtained partly from a mature filter, was first used, settled sewage being dripped in at the upper end. To increase the length a surface 34 ft. long, made of half iron pipes 3½ in. in diameter, was also used.

It was found that "when sewage is passed over a surface in presence of air the organic matter is gradually deposited and forms a tenacious slime. The organic matter first deposited is that kind which gives rise to sulphureted hydrogen when fermented anaerobically. The slime has the property of withdrawing colloidal matter from sewage and acts also as a reducing agent. Disintegration of the slime began 10 weeks after starting the experiment and

coincided with the appearance of small worms. At the same time nitrification set in. Oxidation thus appears to be related to slime disintegration.

"Nitrification was never noticed after the sewage traveled 10 ft., and probably could not take place in the first 16 ft., because of the thickness of the slime. The free and saline ammonia which disappears from the settled sewage was not all recovered as oxidized nitrogen in the effluent.

"The purification of sewage depends on the rate of treatment, or, in other words, varies with the surface used. A coarse filter is usually constructed with large material at the bottom, and graduated so that finer material is on the surface. The reverse process of having large material at the top and finishing with the smaller material below the center would probably prove more efficient."

Studies on the process of removal of sulphureted hydrogen from tank effluent by filters using the same apparatus showed that "sulphureted hydrogen (8–10 parts S per 100,000) in a solution of tap-water is mostly absorbed by the slime after traveling 10 ft., when passed over surfaces which have previously been treating sewage, probably as sulphid. Part is converted into sulphate (about 15 per cent), but this is largely increased when the apparatus is resting. A weak solution of sulphureted hydrogen (2 parts S per 100,000) is retained after traveling 10 ft., and nearly all after 4 ft., but it is all recovered by oxidation to sulphate. The slime absorbs sulphate from sewage, but the records are insufficient to show what actually happens to the sulphate."

Formula for determining settling periods in basins or tanks, T. Saville (*Engin. News-Rec., 86 (1921), No. 15, p. 647*).—A formula for calculating settling periods in the treatment of water or sewage for special use where it is desired to determine the settling periods directly for various dimensions of tank without finding the velocity of flow is derived as follows: $S=\frac{7.5\ LAN}{Q}$, in which S=the the settling period in hours, L=length of tank, A=cross-sectional area of tank, N=number of hours during which flow is assumed to occur, and Q=total flow in gallons per day.

Operating a home heating plant, A. M. Daniels (*U. S. Dept. Agr., Farmers' Bul. 1194 (1921), pp. 28, figs. 8*).—The requirements that should be met in order to heat the home satisfactorily are discussed, and advice is given concerning the selection, installation, and operation of home heating plants.

RURAL ECONOMICS AND SOCIOLOGY.

Preliminary report on farm organization in Twin Falls and Latah Counties, B. Hunter (*Idaho Sta. Bul. 123 (1921), pp. 11*).—The first of two projects which have been undertaken in this region by the station cooperating with the Office of Farm Management and Farm Economics, of the U. S. Department of Agriculture, for the purpose of studying crop rotation and cropping systems that should be followed as well as the relative profitableness of the different crops and classes of live stock is reported.

Considerable data secured in November and December, 1919, on 200 farms in the vicinity of Twin Falls, Idaho, covering the period from December, 1918, to December, 1919, are presented in detail. The average crop yields per acre for these farms were as follows: Wheat 38 bu., barley 40 bu., potatoes 137 cwt., beans 1,122 lbs., sugar beets 9.2 tons, alfalfa hay (3 cuttings) 3.9 tons, red clover hay (1 cutting) 1.1 ton, red clover seed 286 lbs., and alsike clover seed 318 lbs.

The average number of animal units kept per farm varied from 7 for the group of smallest farms to 21.3 for the group of largest farms. For the 200

farms as a whole, 82 per cent of the receipts were from the sale of crops, 11 per cent from the net increase from live stock, 2 per cent from miscellaneous sources, and 5 per cent from an increase in feed and supplies.

The average expenses ranged from $1,086 for the group of smallest farms to $4,249 for the largest-size group. The percentage of expenses required for labor increased steadily from 22 per cent for the group of smallest farms to 40 per cent for the group of largest farms.

The sum of labor income plus family perquisites, representing the full amount the farmer has left for his labor after allowing 7 per cent for the use of the farm capital, averaged $662 for the group of smallest farms, $537 for the second-size group, $928 for the third, $1,381 for the fourth, and $1,188 for the fifth, the average for the 200 farms being $940.

The average return on the capital of the 200 farms was 7.2 per cent. The group of smallest farms made 6.2 per cent on the average farm investment and the largest 7.3 per cent. The fourth-size group, including the 80-acre farms, made the highest return on capital, while the 40-acre farms made the lowest.

Direct crop labor requirements, the influence of crop yields on the return on capital, and the relation of size of farm to the efficient use of labor and machinery are analyzed and the data tabulated.

Cost data for the sugar beet crop in this region are tabulated on the basis of 44 records and a total of 687 acres of beets. The figures indicate that the total average cost of producing sugar beets in Twin Falls County, Idaho, 1919, the use of land included, was $136.39 per acre and $12.50 per ton. Of the total cost per acre, labor was 54.2 per cent, manure 2.5 per cent, seed 1.7 per cent, water 2.3 per cent, taxes and insurance 2.7 per cent, machinery 5.3 per cent, overhead 6.1 per cent, and land 25.2 per cent. When the use of land was excluded from the cost items, the average costs were $102.10 per acre and $9.36 per ton.

The average yield of beets for the 687 acres was 10.9 tons, the price received per ton was $11, and the margin of profit per acre $22.78. At an average valuation of $442 per acre, a return of 5.15 per cent on the investment was realized.

Some types of irrigation farming in Utah, E. B. Brossard (*Utah Sta. Bul. 177 (1920), pp. 140, figs. 21*).—The original investigation was conducted during 1914, 1915, and 1916 by the author, employed by the U. S. Department of Agriculture and the Utah Experiment Station. Types of farming as reflecting the interrelationships of economic factors were studied from a total 950 farm records for from one to three years in eight areas, including one each in Cache, Salt Lake, Utah, Carbon, Millard, Emery, Sevier, and Beaver Counties. The plan of study enumerates and describes the individual crop and stock enterprises, determines the magnitude and importance of the separate enterprises and combinations and proportions, and analyzes the factors affecting their choice and combination. The Hyde Park area, in Cache County, is treated in considerable detail, the others only briefly.

The farm well planned, D. H. Otis (*Wisconsin Sta. Bul. 328 (1921), pp. 28, figs. 22*).—Recommendations are made for planning the size and shape of fields on 10 typical Wisconsin farms, as well as crop rotations best suited to Wisconsin conditions.

Comparison of rotations, crop costs, and net receipts per acre, H. R. Hoyt (*Ohio Sta. Bul. 344 (1920), pp. 274, 275*).—Comparison is made of rotations on the Paulding County Experiment Farm on the basis of five-year average yield and value per acre, 1915–1919. Labor and miscellaneous costs and net receipts per acre are tabulated for rotations followed on tenth-acre plats.

Cost accounting work, R. R. Barker (*Ohio Sta. Bul. 344 (1920), p. 467*).—From records kept on the Madison County Experiment Farm as to the relative costs, labor costs especially, of growing different crops and of performing different operations, it was found, for instance, that in 1919 it cost $18.59 per acre to cut and husk corn and put the corn and stover into the barn; while it cost $26.24 per acre to put the same kind of corn into the silo. It was found also that 34 man hours and 59 horse hours were required to grow and harvest an acre of corn husked on the stalk, while an acre of oats required 19.5 man hours and 23.5 horse hours for growing and harvesting.

Cost of producing wheat, M. R. Cooper and R. S. Washburn (*U. S. Dept. Agr. Bul. 943 (1921), pp. 59, pls. 2, figs. 9*).—Tabulated cost data derived from 481 records, of which 197 were obtained in five representative counties of the principal spring-wheat States, North and South Dakota and Minnesota, and 284 in nine counties in Kansas, Missouri, and Nebraska, important winter-wheat States, furnish the basis of this analysis of the average cost and variation in cost on individual farms and groups of farms in each area visited, as well as of the more important reasons for the great variations in cost per acre and per bushel on individual farms. A total area of 43,940 acres seeded to winter wheat, yielding 635,124 bu., and a total area of 44,218 acres seeded to spring wheat, with the total production of 362,047 bu. for the crop year 1919, were involved.

The average yield of spring wheat was 9 bu. per acre in the United States as a whole in 1919, and 8.4 bu. per acre for the total spring-wheat area surveyed; the average yield for all winter wheat in 1919 was 14.7 bu. per acre, while that for farms surveyed was 14.9 bu. per acre. The largest number of spring-wheat farms fell within the group having a yield of from 5 to 10 bu. per acre, while the largest number in the winter-wheat districts were included in the group having a yield of from 15 to 20 bu.

The difference between the gross cost and the sum of credits for pasture and any straw utilized on the farm is taken to be the net cost of producing wheat. The average cost expense of each item was computed on a weighted basis by dividing the total cost of each item by the total wheat acreage. An analysis of the total cost for spring and winter wheat shows that labor constitutes about 32 to 35 per cent of the total cost of production, thrashing about 8 per cent, materials from 10 to 17 per cent, land rent from 24 to 30 per cent, and other costs from 17 to 19 per cent.

The average cost of producing winter wheat was $27.80 per acre and $1.87 per bushel as compared with an average cost for spring wheat of $22.40 per acre and $2.65 per bushel. The difference in cost per bushel of producing spring and winter wheat is due to a lack of relation between the cost of producing an acre of wheat and yield obtained, the cost per acre of winter wheat being 24 per cent greater than for spring wheat, whereas the yield per acre was 77 per cent greater. In the spring-wheat area about 33 per cent of the production was on the farms having costs above the average; in the winter-wheat area about 40 per cent of the production was on farms having costs above the average.

Summaries of costs by districts, range in cost per acre by counties, net cost per bushel, variations in items of cost, array of farms according to cost per bushel by counties, cumulative percentage of acreage grown at various bushel cost, cumulative percentage of total production, and individual costs per acre are tabulated and interpreted.

The cost of raising grain, P. S. Goodman (*Amer. Elevator and Grain Trade, 39 (1921), No. 9, pp. 707, 708*).—Certain data derived from an inquiry into the costs of producing the principal crops, made immediately after the 1910 census and published in the *Crop Reporter* of the U. S. Department of Agriculture in

1911, are extended on the basis of annual reports in the same publication of labor costs, average yields, monthly prices of products on the farms, and land values for the years 1916 to 1920, inclusive. The study is carried out with respect to wheat, corn, and oats in the United States as a whole. Corn and oats in Iowa and wheat in Kansas are similarly studied.

Cost of canning Wisconsin peas, T. MACKLIN (*Wisconsin Sta. Bul. 327 (1921), pp. 20, figs. 6*).—A complete analysis of facts submitted by 22 of the 88 Wisconsin pea-canning factories as to the various elements of cost involved in the business indicated that in 1919 the cost of raw peas amounted to 26.4 per cent, cans represented 22.7, boxes 5.2, direct labor 8.7, all other expenses 25.5, and profit before deduction of income taxes 11.5 per cent of the factory selling price of No. 2 size cans of peas.

It is said that over $16,000,000 is invested in land, buildings, and equipment for this industry, $9,000,000 by farmers. About 56,672 acres were devoted to the growing of peas for canning in Wisconsin in 1919, one-fifth of which area was owned and cultivated by pea-canning companies.

The adjustment of the farm business to declining price levels, H. C. TAYLOR (*Jour. Farm Econ., 3 (1921), No. 1, pp. 1–9*).—The points made in this presidential address with regard to the curtailment of expenses of agricultural production and marketing have been previously noted (E. S. R., 44, p. 196). In regard to the problem of agricultural protection, the comment is made that "whether the world conditions are such as to facilitate a world economy or to necessitate a national economy, the American farmer is now in a state of mind to demand protection in the home market for his products. If we are now to enter upon a period of agricultural protection similar to that in England known as the 'Corn Laws' following the Napoleonic Wars, we should study with care the English experience."

Address of Henry C. Wallace, Secretary of Agriculture, before the Farmers' Grain Marketing Committee of Seventeen, Chicago, April 6, 1921 (*County Agent and Farm Bur., April, 1921, pp. 5–7; also in Wallace's Farmer, 46 (1921), No. 15, pp. 642, 643, fig. 1; abridged in U. S. Dept. Agr., Market Rptr., 3 (1921), No. 18, pp. 273, 286*).—The author's conception of the proper function of the Government in furnishing information with regard to the supply and demand, and facilities and cost of marketing, perishable and other farm crops, is set forth. The plan of cooperative marketing evolved by the committee addressed is commended as being founded on practical experience, as being an adjustment of existing systems and not an attempt to create a monopoly or fix a price.

Yearbook of the International Farm Congress (*Yearbook Internatl. Farm Cong., 1920, pp. 175, pls. 6*).—Included in the proceedings of the fifteenth annual session of this body, held at Kansas City, Mo., December 9–11, 1920, are addresses by H. J. Waters and H. C. Taylor, both of whom emphasize from one viewpoint or another the necessity of economy in agricultural production. Other speakers were officers of the congress and men interested in the production and marketing of agricultural products. Resolutions adopted and the constitution of the congress, its history and purposes; a roster of a number of farm organizations; and other items of general information are given.

Food supplies in peace and war, R. H. REW (*New York and London: Longmans, Green & Co., 1920, pp. VII+183*).—A survey is made of the world's food supply in its relation to world consumption. The author concludes that there is no cause for alarm about a general food shortage while the world is at peace. He believes that the actual limit of food production is one of the least serious aspects of the food question.

Special emphasis is given to the situation of Great Britain. The solution of England's problem, according to the author, lies in stimulating the production of materials for export as well as of produce for home consumption. The multiplication of small land holdings to get more men on the land, the bettering of the social and economic conditions of farm workers, and further support by the State of agricultural education and research, are the means suggested for increasing agricultural output.

The British corn trade from the earliest times to the present day, A. BARKER (*London and New York: Sir Isaac Pitman & Sons, Ltd., [1921], pp. VIII+132, figs. 10*).—Famine and price fluctuations resulting in England from poor seasons, pestilence, and the perils and limitations of shipping in early English history, and early attempts to legislate against speculation in food grains, are described. Grain prices between 1600 and 1815 are reviewed in some detail as reflecting war and peace and consequent agricultural conditions. The sliding scale of duty on imported grain put into effect by the so-called "Corn Laws" for the protection of the British grower is discussed, and the various evasions resorted to and the opposition aroused are related. The growth and development of the modern corn trade is attributed to the abolition of high protective duties, the development of steam navigation, the growth of British industries, and the increase of urban population, together with the opening up of new wheat lands in western countries. The effects of the recent war and the events leading up to and necessitating the temporary paralysis of British corn trade under government control are set forth.

The present potential grain production in Italy, G. ZATTINI (*Min. Agr., [Italy], Uffic. Statis. Agr., Not. Period. Statis. Agr., 11 (1920), No. 3, pp. 1–57*).—This article presents a résumé of grain statistics for the period 1909–1920 by years, regions, and provinces, showing maximum and minimum acreages and production. This study does not encourage an attempt to increase grain production. It is shown that the amount produced is at present just about sufficient for the home demand.

Modern agriculture, with special reference to progress in Canada since confederation in 1866, G. C. CREELMAN (*Jour. Roy. Soc. Arts, 69 (1921), No. 3562 pp. 209–228*).—In these pages there is given a general résumé of census figures, mainly since 1870, with discussion, showing the areas, yields, and values of the principal Canadian crops, numbers of live stock, production of dairy products, and fruit growing and trade. A brief note relates the beginning and development of agricultural education in the provinces. The discussion is contributed to by D. Hall and others.

Agusan: Its natural resources and opportunities for development, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 2, pp. 100–111, pls. 6*).—A general description of this region and a report of climatic conditions, population, history, agriculture and food crops, and its commerce and communications are given in this article. Illustrations include maps and photographs of the country showing typical vegetation.

Modern land settlement, G. B. SCHELL (*Calif. Univ. Jour. Agr., 7 (1921), No. 3, pp. 3–5, 30, figs. 2*).—Certain land colonization projects under private direction, particularly one in the suburbs of Sacramento, Calif., are briefly described.

Agricultural questions (*Geneva: Internatl. Labor Off., 1921, pp. 88*).—Special questionnaires have been drawn up directing the attention of the various governments participating in the third session of the International Labor Conference, to be held at Geneva in October, 1921, to the regulation of agricultural labor. The existing legislation and available information with reference to the adaptation of the resolutions of the Washington conference of November, 1919,

to agricultural labor, especially the regulation of the hours of work, means of preventing and providing against unemployment, and the protection of women and children, also on the subjects of technical agricultural education, housing of agricultural workers, the guaranty of the right of association and combination for agricultural workers, and their protection against accident, sickness, invalidity, and old age, are briefly presented in each case preceding the outline list of questions.

Agricultural labor in its international relations (*Ireland Dept. Agr. and Tech. Instr. Jour., 21 (1921), No. 1, pp. 13–17*).—In these pages is offered an extract from the debate in the commission on economic and social policy of the fifth general assembly of the International Institute of Agriculture, on the motion made, in view of the possibility of the application of international labor regulations to farm work, recommending a more thorough study by the institute itself of the economic, juridical, and social conditions of life of agricultural wage earners.

Marketing problems of Minnesota farmers, H. J. Hughes (*Minn. Dept. Agr. Bul. 11 (1920), pp. 23*).—A discussion of the market crops of Minnesota and the particular marketing conditions which they require, together with notes on the rôle of cooperation in this connection, is offered. Certain principles exemplified in an agency for marketing Minnesota potatoes and perishable products are outlined, and their possible application to the marketing of wool, dairy products, live stock, eggs, hay and roughage, grain, and farm timber is suggested.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 8 (1921), No. 44, pp. 11*).—This number continues the usual monthly list of products which farmers have for sale, with notes on cooperative marketing.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 15, pp. 225–240, fig. 1; 16, pp. 241–256, fig. 1; 17, pp. 257–272; 18, pp. 273–288*).—The usual abstracts of information of domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products are given in these numbers, together with analyses of foreign market conditions. Brief special articles on this year's prospective harvest of wheat in India and Rumania appear in Nos. 15 and 16, and in No. 15 there is also an account of live-stock marketing costs with tabulated information relating to maximum and minimum commission charges on various classes of live stock in 1914 and 1921 and yardage charges per head. An investigation of the numbers of cattle to be pastured and pasturage charges in Kansas and neighboring regions is reported on in No. 16. Estimates arrived at on basis of a survey by the Bureau of Markets and from other sources are given in No. 17, indicating the percentage of the marketable surplus of hay sold, and pointing out the extent and causes of present price declines for hay. In No. 18 there is published a portion of the address by Secretary H. C. Wallace, as noted above.

AGRICULTURAL EDUCATION.

Vocational education, D. Snedden (*New York: Macmillan Co., 1920, pp. XI+587*).—This book is devoted primarily to a discussion of current problems in vocational education for the rank and file of workers. The author analyzes the essential factors of the problem and then states his own hypothetical surmises and conclusions. Bibliographies, occupational statistics, and a terminology of vocational education are included.

For the purposes of this book a fundamental distinction is made between (1) direct vocational education, taught by the schools, including only those forms in which training for a specified vocation is the primary, central, and controlling purpose, and in which production, recreation, control, etc., are all

regarded as secondary, minor, or incidental purposes; and (2) indirect vocational education, or vocational by-education, which is a by-product of activities designed primarily for other purposes and is taught through apprenticeships on farms, and in homes, shops, offices, mines, etc.

The chapter on vocational education for the agricultural callings discusses the varieties of vocational agricultural education; the home project school; debatable issues with reference to the organization and method of instruction in secondary vocational agriculture as indicated by Eaton (E. S. R., 38, p. 598; 39, p. 797); vocational aims; specialization of function; focal and marginal fields; unsettled problems, such as the acquisition of land, enlarging capital units, and leaving the farm; the project method of teaching agriculture elucidated by a summary of the conditions which ideally might be expected to prevail, together with the vocational pedagogy of aim and method implicit in such conditions; rural schools and vocational education for the farming callings, including findings on the aims of rural school elementary education, rural secondary education, agriculture in general education, and vocational secondary education.

In the author's opinion the greatest practical dangers in the evolution of workable schemes of agricultural education will come from the attempts to train boys to be "farmers" in the general sense, as the "all-round farmer" or general farming fits very poorly into the economy of the twentieth century. Vocational education must follow the specialization produced by economic forces. In framing the plans of vocational education for agricultural schools he would be guided chiefly by the practice of successful modern farmers, distinguishing sharply between their capacities or powers involved in abilities to do, to execute, or to perform, and those involved in abilities to appreciate the need of the services of others and to appraise or evaluate that service when rendered by them. General analyses of different types of farm life in various regions are considered desirable in order that the educative processes may be closely adapted to individual and community needs. The two problems at present found most pressing are the provision of opportunities for practical training for city boys and the problem of combining secondary vocational agricultural education with preparation for higher institutions for the study of agriculture.

Before the agricultural colleges of this country will train qualified teachers of vocational agriculture effectively, the author believes two antagonistic conditions will have to be overcome. The actual requirements of successful vocational education for the agricultural vocations must be defined, formulated, and made a matter of demonstration, and the college authorities and the other related agencies of scientific agriculture must become convinced that there is a place, and a large place, for vocational education in agriculture below the level of the college. This problem may be simplified when American secondary education in its administration shall refuse to accept a bachelor's degree, even when it has been obtained partly on the basis of so-called educational courses, as indicating the equivalent of professional preparation for teaching. At least one year of definite professional preparation in addition to the requirements of the bachelor's degree should be met on the part of secondary school-teachers, as is now required in one State and provided by a few colleges. "These agricultural colleges, though offering ostensibly vocational education, are still tied to the chariot wheels of the B. S. degree, which can in no true sense be a professional degree, and which must always seriously deflect the aims of professional education."

In the chapter on vocational home-making education the author submits a few specific problems, together with methods for their further study and certain

tentative proposals for criticism. The characteristics and functions of homes, the vocation of home making, the sociological scope and standards of the home-making functions, the "case method" of study, the project method of teaching home making, the organization and administration of home-economics education, and household arts as liberal education are discussed. The author considers the more effective coordination of home-making education with the home activities of the pupils and the age at which it is efficiently practicable to begin systematic vocational home-making education as the two chief problems of home-making education at the present time.

Introduction to vocational education, D. S. HILL (*New York: Macmillan Co., 1920, pp. XVII+483, figs. 7*).—This is a statement, with an introduction by M. V. O'Shea, of facts and principles related to the vocational aspects of education below college grade. It includes a discussion of the relation of public education to democracy, the meanings, ideals, and adjustments of vocational education to the individual and society, its relation to social problems, the auspices of vocational education, the history of Federal aid, and the development of Federal cooperation. A chapter on problems in agricultural education is devoted to a discussion of the fields of instruction, elementary agriculture, secondary instruction, study and teaching *v.* practice of agriculture, the machinery for adequate agricultural education, applications of the Smith-Hughes law, pedagogical problems, agricultural education in philanthropic and other institutions, the improvement of rural life, problems, and selected references.

The author concludes that both in collegiate and in secondary schools distinctions should be recognized between agricultural courses that are vocational in aim and those agricultural courses that are intended merely to enlarge knowledge and appreciation and to be an adjunct of liberal education. Better coordination is needed between the numerous instrumentalities of training in agriculture at public expense, whether in elementary, secondary, or higher institutions. Pedagogical questions of organization of programs, courses of study, and curricula are pressing, and should be worked out through conference, research, and united efforts of teachers, superintendents, university professors, and State and Federal specialists.

A chapter on the practical education of girls and women considers underlying principles, home economics and household arts education, vocational home-making courses, industrial and trade and extension schools for women, applications of the Smith-Hughes Act, and other vocational education of women. Problems and selected references are included.

The problem of summer teaching in connection with project supervision, A. W. NOLAN (*U. S. Bur. Ed., Sec. School Circ. 7 (1920), pp. 6*).—This paper was presented at the meeting of the American Association for the Advancement of Agricultural Teaching on October 19, 1920, and is based on replies of State supervisors of agricultural education to a questionnaire on the subject.

The author states that 30 of these supervisors reported that they required no systematic book study of vocational students during the summer months, project study outlines and records affording the only written guides in the hands of the pupils for the summer work. In many cases these provided full instructions for carrying on the practical work of the project, for recording all transactions in connection therewith, and for reference readings to be used for a fuller understanding of the project in all its problems and related interests.

The opinions, gathered from 33 replies, may be summed up in the statement that summer teaching should consist largely of personal individual instruction as needed, based upon the seasonal problems of the farm practice; such instruction to pertain to the improvement of skill in the manipulative processes, the

solution of problems arising in connection with the project or farm practice, and to principles, basic facts, and related interests necessary for an intelligent understanding for the best practice. In addition to personal conference with a boy at the scene of his work, the author suggests as desirable a project record book for cost accounting and notes relating to the boy's record of the project, and a fully worked-out manual or text, supplied with references at each point, upon the project basis, for each major enterprise likely to be chosen by the vocational students as projects.

Philosophy of agricultural instruction, R. KRZYMOWSKI (*Philosophie der Landwirtschaftslehre. Stuttgart: Eugen Ulmer, 1919, pp. [V]+164, figs. 2*).—The author discusses the fundamental principles of agricultural instruction, including its historical development from the time of Albrecht Thaer, and previous thereto, through that of Justus von Liebig; agriculture as an industry and as a natural phenomenon, and its indispensableness; its position, together with its objects, in the development of intellectual culture; its rationalism and related factors; experimental and nonexperimental inquiry in agriculture; the principle of selection and the historical development of agriculture; supplementing systematic and experimental agricultural instruction by agrarian history and geography; empirical-practical knowledge; and the esthetic element in agriculture and agricultural instruction. A consideration of agrarian geography is appended.

What the agricultural promotion school is and its objects, R. RENTSCHLER (*Württemb. Wchnbl. Landw., 1920, No. 47, pp. 435, 436*).—The proposed organization of agricultural promotion schools (Förderschulen) of intermediate grade, to form the connecting link between the lower agricultural winter and farm schools and the higher agricultural education institutions in Germany, is briefly outlined. As planned, the school would offer a 2-year theoretical course to which would be admitted only students of 19 and 20 years of age who have completed a 2-year course at an agricultural winter school, a farm school, or a viticultural or horticultural school or its equivalent. The advisability of giving special agricultural instruction in these schools is doubted, since this is regarded as the field of the lower and higher agricultural education institutions. Such subjects as economic geography, local geography, the history of civilization, political economy or civics should receive special attention. Agricultural mechanics, geometry, planimetry, and stereometry (surveying and leveling), as well as technical drawing, should be comprehensively taught, and the science subjects should be taught in their relation to agriculture.

Report on the Agricultural Instruction Act, 1919–20 ([*Canada Dept. Agr.*] *Rpt. Agr. Instr. Act, 1919–20, pp. 39*).—This is the annual report for 1919–20 on the allotments and expenditures under the Agricultural Instruction Act and the activities conducted thereunder, including instruction and extension work, colleges and schools of agriculture, veterinary colleges, elementary agricultural education including nature study or rural science and elementary agriculture, junior extension work, school and home gardens, boys' and girls' clubs, and school fairs.

[Agricultural instruction in Ontario, 1919], M. W. DOHERTY (*Ontario Min. Agr. Rpt., 1919, pp. 5–15, 19, 20, 23–66, 73–75, 77, 78*).—This report includes progress reports for 1919 on the activities of the Ontario Agricultural College; the Ontario Veterinary College; farmers' and women's institutes; agricultural representatives, including school fairs and contests, short courses in agriculture, activities of junior farmers, and boys' and girls' club work; the Kemptville Agricultural School; and grants under the Federal Agricultural Instruction Act. It is reported that all degrees for work in the Ontario

Veterinary College will in future be conferred by the University of Toronto, and that the main degree will be B. V. Sc. instead of the degree of V. S. conferred heretofore by the college itself.

First biennial report of the State Board for Vocational Education, M. S. LEWIS (*Idaho Bd. Vocat. Ed. Bul., 4 (1921), No. 1, pp. 55, figs. 26*).—This is the report of the department of vocational education of Idaho for the biennium ending December 31, 1920.

By 1920 the number of approved schools had increased to 31, with 904 pupils in agriculture. For the biennium 19 men received training in teaching agriculture at the University of Idaho and 58 by means of itinerant teacher training.

In 1919–20, the number of high schools reimbursed for instruction in vocational home economics was 16, with a total enrollment of 328 students. The enrollment of teachers in the training course in home economics at the University of Idaho increased from 48 in 1918–19 to 60 in 1919–20.

Fourth annual regional conference in home economics—Southern States (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1921), No. 10, pp. 158, 159*).—This report on the proceedings of this conference, held at Montgomery, Ala., January 3–5, 1921, inclusive, presents the recommendations of committees on part-time and evening schools, on standards for teachers of home economics in the South, and on cooperative programs for schools maintaining vocational departments of both agriculture and home economics.

It was recommended that a home economics certificate for teaching in high schools in this region be granted only upon the completion of a college course of 60 college credit hours (120 semester or 180 term hours, exclusive of physical training), and 2 years of vocational experience. Of these credit hours 50 are to be in required subjects. The percentage distribution of time would be as follows: English 10, science (physiology, bacteriology of the home, inorganic and organic chemistry) 20, are (costume designing, house furnishing and decoration) 6.6, education (general and special methods, observation and practice teaching of not less than 30 lessons to a high school class) 15, sociology and economics 5, home economics (garment making, clothing and textiles, millinery, food study and meal preparation, dietetics, home nursing, home management, including supervised work in a practice cottage or apartment for 6 weeks per student, and the care of children) 26.6, and electives 16.8.

It was also recommended that where agriculture is taught some type of home economics should be introduced, which, together with the related subjects, should be arranged to come at the same time as the agricultural subjects.

Organization and results of boys' and girls' club work, Northern and Western States, 1919, G. E. FARRELL and I. L. HOBSON (*U. S. Dept. Agr., Dept. Circ. 152 (1921), pp. 35, figs. 7*).—The object of boys' and girls' club work is set forth, its organization described, and reports presented of some of the leading results secured in the Northern and Western States in 1919. Various benefits of club work to the members and to the community are emphasized.

MISCELLANEOUS.

Thirty-third Annual Report of Indiana Station, 1920 (*Indiana Sta. Rpt. 1920, pp. 59, figs. 5*).—This contains the organization list, a report of the director summarizing the activities of the station, publications of the year, changes in staff, etc., and a financial statement for the Federal funds for the fiscal year ended June 30, 1920, and for the remaining funds for the fiscal year ended Sep-

tember 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Maryland Station, 1920 (*Maryland Sta. Rpt. 1920, pp. IX+140, figs. 61*).—This contains the organization list; a report by the director on the work and publications of the station; a financial statement for the fiscal year ended June 30, 1920, and reprints of Bulletins 228–236, previously noted.

Report from Holly Springs Branch Experiment Station for 1915 to 1920, inclusive, C. T. AMES (*Mississippi Sta. Bul. 193 (1920), pp. 22, figs. 2*).—The experimental work covered in this report is for the most part abstracted elsewhere in this issue.

Thirty-eighth Annual Report of New York State Station, 1919 (*New York State Sta. Rpt. 1919 [pt. 1], pp. VII+554, pls. 44, figs. 37*).—Part 1 of this report contains the organization list; a financial statement for the fiscal year ended June 30, 1919; a list of the periodicals received by the station; meteorological observations abstracted on page 113 of this issue; and reprints of Bulletins 458–461, 463–466, 468, and 470; Technical Bulletins 66–74; and popular editions of Bulletins 459, 463, 466, and 468, all of which have been previously noted.

Thirty-ninth Annual Report of Ohio Station, 1920 (*Ohio Sta. Bul. 346 (1920), pp. XL+[6], fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and a report of the director summarizing the work and publications of the station during the year, with a brief summary of the work of the station during its entire history. The current experimental work reported is for the most part abstracted elsewhere in this issue.

County experiment farms in Ohio, annual reports for 1918 and 1919 (*Ohio Sta. Bul. 344 (1920), pp. 223–478, figs. 25*).—This contains reports for the nine county experiment farms in Ohio, including financial summaries, crop and labor statistics, farm work reports, data on the maintenance of soil fertility, variety comparison, etc. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Virgin Islands Station, 1920 (*Virgin Islands Sta. Rpt. 1920, pp. 35, pls. 4*).—This includes the organization list, and a report by the agronomist in charge as to the work of the station for the fiscal year ended June 30, 1920. A report of the entomologist is included, and rainfall data are appended. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 9 (1921), No. 1, pp. 16*).—This number contains brief articles on the following subjects: The State Division of Agriculture, by A. L. Melander; Finding a Location and Beginning with Bees, by G. W. York; Resetting Old Berry Plants, and Tomato Culture in Western Washington, both by J. L. Stahl; Adapted Pasture and Hay Grasses, and Varieties of Spring-sown Crops, both by M. E. McCollam; Common Chick Diseases, by W. T. Johnson (see p. 183); and Care of Rabbits, by F. W. Arms.

An agricultural almanac for 1921, compiled by B. ADAMS (*U. S. Dept. Agr., Farmers' Bul. 1202 (1921), pp. 64, figs. 2*).—This publication, compiled from sources within the Department for the use of farmers, gardeners, householders, and others, contains the usual sunrise and sunset data, gestation tables, notes on agricultural operations suited to the various months, a chronology of important agricultural events, and miscellaneous farm helps as to fertilizers, sprays, weights of commodities, etc.

NOTES.

Arizona Station.—Leslie Beaty, county agent of Otero County, N. Mex., has been appointed manager of the station date orchard at Yuma.

Florida University and Station.—J. C. Cooper, jr., of Jacksonville, and W. S. Weaver, of Perry, have been appointed to the board of control, vice J. B. Hodges and H. B. Minium, whose terms expire July 1. P. K. Yonge has been appointed chairman of the board.

J. B. Thompson, specialist in forage crops, resigned August 9 to become agronomist in charge of the Virgin Islands Station. J. M. Coleman has been appointed assistant chemist, beginning July 15, in connection with the soft pork investigations of the station.

Georgia Station.—W. A. Morgan, a recent graduate of the Georgia School of Technology, has been appointed assistant chemist, beginning July 15.

Purdue University and Station.—The tragic death is noted of President W. E. Stone on July 16 while ascending Mount Eanon in the Canadian Rockies.

President Stone was born in Chesterfield, N. H., June 12, 1862. He was graduated from the Massachusetts Agricultural College in 1882 and served as assistant chemist in the Massachusetts Station from 1884 to 1886. In 1888 he received the degree of Doctor of Philosophy from the University of Goettingen, and on returning to this country became chemist at the Tennessee Station. In 1889 he was appointed professor of chemistry in Purdue University and in 1892 vice president, continuing in this capacity until his election as president in 1900.

During his long administration the university underwent remarkable development, especially along agricultural lines, and he became widely known as one of the leading executives in the land grant college group of institutions. He was for years one of the dominant figures in the Association of American Agricultural Colleges and Experiment Stations, serving repeatedly as a member of the executive committee and as its president in 1911–12, and was the author of the plan under which the association became the Association of Land Grant Colleges in 1919.

C. W. Carrick, who has been engaged in poultry extension work in the State, has been appointed associate in poultry husbandry in the station. E. H. Parfitt has been appointed dairy bacteriologist; C. R. Cleveland, assistant entomologist; and Leroy G. Gordner, assistant in short courses and exhibits.

Maine University.—Dr. R. J. Aley has resigned as president to become the head of Butler College, Indianapolis, beginning September 1.

Maryland University.—*Breeder's Gazette* notes that B. E. Carmichael, formerly of the Ohio Station, has been appointed extension specialist in animal husbandry, beginning July 5.

Massachusetts College and Station.—President K. L. Butterfield has been granted leave of absence until February 1, 1922, in order to serve with the Chinese Educational Commission in making a special study of agricultural education in China and Japan. Dean E. M. Lewis has been designated as acting president.

Cooperative investigational work has been started by the station on the control of apple scab in and around Littleton. Arthur P. French has been appointed investigator in pomology, beginning July 11. Miss Marguerite G. Ickis, curator in the department of botany, resigned July 31.

Cornell University.—Dr. Livingston Farrand, chairman of the central committee of the American Red Cross and formerly adjunct professor of psychology and professor of anthropology in Columbia University and president of the University of Colorado, has been appointed president of the university, vice Dr. J. G.

Schumann, who resigned about a year ago after 28 years' service, and whose appointment as minister to China was recently confirmed by the U. S. Senate.

By a reorganization effective July 1, the department of farm crops has been discontinued, the division of vegetable gardening has become the department of vegetable gardening, and the department of soil technology is now the department of agronomy. Of the members of the farm crops staff, E. V. Hardenburg is now assistant professor of vegetable gardening, and J. H. Barron and H. P. Cooper have been transferred to the department of agronomy as extension professor and instructor, respectively, of field crops. R. G. Wiggans has been transferred to the plant breeding department. The new agronomy department will deal with all phases of crop production, and the plant breeding department with plant improvement work.

Dr. George F. Warren, head of the department of agricultural economics and farm management, has been granted leave of absence until February 1, 1922, to serve as consulting specialist to the Chief of the Bureau of Markets and Crop Estimates of the U. S. Department of Agriculture. Bristow Adams, chief of the office of publications, has been granted sabbatical leave to be spent in advance study for the second term of 1921–22.

Ohio State University and Station.—Dr. C. L. Metcalf, professor of zoology and entomology in the university, has resigned to become professor of entomology and head of the department in the Illinois University and Station.

In the station the appointments are noted of Edmund Secrest as associate director, and of J. H. Gourley, professor of horticulture and horticulturist of the West Virginia University and Station, as chief of the horticultural department. D. C. Kennard, assistant in poultry studies in the Indianapolis food research laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, has been appointed associate in the department of animal industry in charge of poultry work, vice W. J. Buss, who resigned to engage in commercial work. P. S. White of the same laboratory has been appointed assistant in the poultry division.

West Virginia University and Station.—Appointments, effective July 1, include the following: Eugene P. Deatrick, Ph. D., as associate professor of soils and in charge of the soils department of the station, vice R. M. Salter, resigned; J. H. Longwell as assistant professor in animal husbandry and assistant animal husbandman; Ferris D. Cornell, instructor in farm engineering and in charge of station farm engineering work; Goldan O. Hall, istructor in poultry and assistant in poultry husbandry; and K. S. Quisenberry, instructor in agronomy and assistant in agronomy in the station.

Wyoming University and Station.—The university has awarded the contract for a new heating plant, and construction work has been begun. F. W. Geddes, Dean Prosser, and J. A. Elliott have been appointed members of the board of trustees to succeed C. D. Spalding, J. M. Carey, and C. P. Arnold. Dr. E. H. Lehnert, head of the veterinary department, and H. P. Kjerschow-Agersborg, assistant professor of zoology and assistant parasitologist, have resigned.

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EXPERIMENT STATION RECORD.

VOL. 45. ABSTRACT NUMBER. NO. 3.

RECENT WORK IN AGRICULTURE SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The physico-chemical foundations of biology with an introduction to the basic principles of higher mathematics, E. EICHWALD and A. FODOR (*Die Physikalisch-Chemischen Grundlagen der Biologie mit einer Einführung in die Grundbegriffe der Höheren Mathematik. Berlin: Julius Springer, 1919, pp. X+510, pls. 2, figs. 119*).—This treatise consists of introductory sections on biological methods and on the basic principles of higher mathematics (integral and differential calculus), followed by sections dealing with the state of matter, atomic and structural theory, the kinetics of chemical reactions, and the doctrine of energy.

Applied chemistry.—I, Water, detergents, textiles, fuels, etc., C. K. TINKLER and H. MASTERS (*London: Crosby Lockwood & Son, 1920, vol. 1, pp. XII+292, pls. 2, figs. 34; rev. in Analyst, 45 (1920), No. 534, pp. 346, 347*).—This handbook has been written as a guide to the practical work in applied chemistry which is given in the last year of the three years' course in household and social science at King's College for Women, London. The laboratory work outlined deals with water analysis, water softeners and soda substitutes, soap, textile fibers, bleaching agents, dry cleaning, air analysis, gaseous fuels, liquid and solid fuels, and materials used for the protection of wood, metal, and other surfaces. A second volume dealing with foods is in preparation.

Organic chemistry for advanced students.—I, Reactions. II, Structure. III, Synthesis, J. B. COHEN (*London: Edward Arnold; New York: Longmans, Green & Co., 1920, 3. ed., pts. 1, pp. VIII+366, figs. 4; 2, pp. VII+435, pls. 2, figs. 60; 3, pp. VII+378*).—This is a reprint of the second edition (E. S. R., 40, p. 709) with the addition of a number of references to recent literature.

Catalysis and its industrial applications, E. JOBLING (*London: J. & A. Churchill, 1920, 2. ed., pp. VIII+144, figs. 12*).—This book deals briefly with the rôle of catalysis in various processes of chemical industry. Literature references are given at the end of each chapter.

An introduction to the chemistry of plant products.—I, On the nature and significance of the commoner organic compounds of plants, P. HAAS and T. G. HILL (*London: Longmans, Green, and Co., 1921, 3. ed., pp. XIII+414, figs. 3*).—The third edition of this work is to appear in two volumes of which this is the first. The present volume is essentially the same in scope as the previous edition (E. S. R., 37, p. 801), dealing primarily with the more chemical phases of the subject, while the second, which is in preparation, is to be devoted to the more purely physiological problems.

The chemical constitution and synthesis of the principal phospho-organic reserve material of green plants, S. POSTERNAK (*Soc. Phys. et Hist. Not. Genêve, Compt. Rend., 37 (1920), No. 3, pp. 70–74*).—The author reiterates his former statement in regard to the synthesis of a phytic acid identical with the natural phytic acid of plant materials, and claims that the inability of Anderson to confirm his work (E. S. R., 44, p. 410) was due to faulty methods of separating the synthesized acid from the reaction mixture.

The preparation and analysis of a cattle food consisting of hydrolyzed sawdust, E. C. SHERRARD and G. W. BLANCO (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 61–65, fig. 1*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., describes the process of manufacture of a hydrolyzed cellulose which has been fed to three dairy cows with good results, as noted on page 275.

Eastern white pine sawdust was digested with 1.8 per cent H_2SO_4 for 15 or 20 minutes under a pressure of 120 lbs. per square inch, sufficient water being added to raise the ratio of water to dry wood to about 1.251. The digested sawdust was then centrifuged to remove the greater part of the acid liquor, the centrifuged material placed in towers, and the remainder of the sugar and acid extracted with hot water. Five complete washings with a quantity of water equivalent to the weight of wood were sufficient to remove practically all of the H_2SO_4. The leached water was mixed with the centrifuged liquor and almost neutralized with $CaCO_3$, and finally decanted or filtered and evaporated under reduced pressure to a thick sirup. The leached material from the towers was screened through a 6-mesh screen and the screenings air dried, mixed with the sirup, and the whole dried to a moisture content of about 12 per cent. To avoid loss of sugar it was found advisable to conduct the drying in an oven at a temperature of from 75 to 85° C.

Analyses by the Schorger method (E. S. R., 37, p. 502) of the unhydrolyzed sawdust and the hydrolyzed stock food are reported, separate analyses for both being made of material passing 100-mesh screens without grinding and the residue ground to pass through a 100-mesh screen. The principal difference between the fine and coarse material in both cases was in the percentage of ash, which was higher in the fine samples. The hot and cold water and alkali soluble materials were greatly increased by hydrolysis, while the ether soluble materials remained about the same. About 45.4 per cent of the original pentosans remained in the finished product. The loss of cellulose brought about by the hydrolysis was 21.68 per cent from which 15.5 per cent of total reducing sugars was produced, showing a yield of sugar approximately 71.5 per cent of the theoretical. The final cellulose differed from that of the original wood in its behavior toward alkali, practically all of the cellulose being converted into a viscous semitransparent mass by 17.5 per cent NaOH, while in the original cellulose over 50 per cent was unaffected. The altered cellulose is thought to be a product intermediate between α-and β-cellulose, and one which is more easily digested in the alkaline intestinal tract than pure α-cellulose. The total quantity of lignin was not appreciably altered. Crude fiber was reduced from an original content of 63.87 and 60.81 to 46.88 and 49.31 per cent.

The apple storage problem (*Idaho Sta. Bul. 122 (1921), p. 21*).—In this progress report on the problem of apple storage, it is stated that "the chemical change taking place in an apple during the period of growth, ripening, and storage can now be followed by means of physical measurements on the expressed juice.

"In the early stages of growth of the apple, hexose sugars predominate. Later in the growth the sugars are followed by a formation of starch as a

reserve material. During ripening sucrose is also formed. In the later stages, in the so-called after-ripening period, sucrose is changed to invert sugars. These changes have been followed by the freezing point method. After-ripening is characterized by increased osmotic pressure, lowering of the surface tension and a marked increase in viscosity of the juice."

The separation of serum proteins, M. Piettre and A. Villa (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 24, pp. 1466–1468*).—A method of separating the constituents of blood serum is described, which consists briefly in neutralizing the serum with normal HCl, using litmus paper as indicator, precipitating the neutralized serum with 2.5 volumes of acetone, filtering, washing the precipitate with ether, digesting it for several hours with distilled water (70 cc. of water to 100 of serum), saturating with CO_2, and centrifuging. The final precipitate contains the insoluble proteins with the exception of albumin; the wash water, the albumin; and the liquid after the original precipitation the fats, lipoids, mineral matter, and all the soluble organic products.

The quantitative determination of tyrosin by means of Millon's reaction, M. Weiss (*Biochem. Ztschr., 97 1919), No. 3–5, pp. 170–175*).—The method described depends upon the dilution of the solution to be tested until the color developed with Millon's reagent is the same as that of a standard solution containing a definite amount of tyrosin.

Nucleic acids.—Their chemical properties and physiological conduct, W. Jones (*London and New York: Longmans, Green & Co., 1920, 2. ed. [rev. and enl.], pp. VIII+150, figs. 3*).—The previously noted monograph (E. S. R., 32, p. 201), of the series edited by R. H. A. Plimmer and F. G. Hopkins, has been revised and enlarged to include the developments in the chemistry of the nucleic acids which have occurred in the intervening six years. Important among these are the definite preparation of the four nucleosids of plant nucleic acid which were in the hypothetical stage at the time of writing of the first edition, and the study of the evolutionary relations of animal species with respect to purin metabolism. Attention is called to the fact that in regard to the most striking feature of purin metabolism, the ability to convert uric acid into allantoin, the lower animals, including the monkey, resemble one another in having a high uricolytic index, while in the ape and man the uricolytic index is zero, the gap thus occurring between the monkey and ape rather than between the ape and man.

Animal fats and oils, L. E. Andés, trans. by H. B. Stocks (*London: Scott, Greenwood & Son, 1920, 3. ed., rev. and enl., pp. VIII+315, figs. 76*).—This is the third English edition by H. B. Stocks of this reference book on the practical production, properties, falsification, and examination of animal fats and oils. The companion volume on vegetable fats and oils has been previously noted (E. S. R., 41, p. 110).

[Progress in fat chemistry in 1919], W. Fahrion (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze, 27 (1920), Nos. 21, pp. 214–216; 22, pp. 225–228; 23, pp. 238–242*).—This continues for 1919 the literature review of theoretical (pp. 214–216), analytical (pp. 225–228), and technical (pp. 238–242) fat chemistry (E. S. R., 43, p. 201).

The chemistry of the polysaccharids, E. Herzfeld and R. Klinger (*Biochem. Ztschr., 107 (1920), No. 4–6, pp. 268–294, figs. 6; abs. in Chem. Abs., 15 (1921), No. 1, p. 99*).—To obtain polysaccharids in a pure form, the authors employ a method which consists briefly in the splitting up of all impurities into alcohol-soluble components by the action of alkali in the warm, precipitation of the intact polysaccharids with 90 per cent alcohol, resolution in water, and reprecipitation with alcohol. Potato and rice starch, yeast polysaccharids,

cellulose, agar, glycogen, and inulin have been thus purified, and were found to be practically ash-and nitrogen free. The behavior of the purified products toward various reagents is described and discussed from the standpoint of colloidal chemistry.

The iodin reaction is considered to depend upon the adsorption of the iodin on the surface of the colloidal particles, the differences in color being due to the degree of dispersion from the less highly dispersed starch, giving a blue color, to the highly dispersed dextrin, giving a reddish brown color. Dextrins are considered to be more highly dispersed starches rather than split products or, expressed in other terms, the action of diastatic enzyms is not one of hydrolysis but one of dispersion. The various plant polysaccharids are considered to differ from one another only in the amount of dextrin particles and in the presence or absence of foreign materials such as lignin, etc. Glycogen is considered as a more dispersed form of starch resulting from the action of solvents in the body.

The chemistry of the polysaccharids, M. Samec (*Biochem. Ztschr., 113 (1921), No. 1–6, pp. 255, 256.*—Exception is taken to the conclusions drawn by Herzfeld and Klinger in the paper noted above, especially on the ground that the action of the 33 per cent NaOH used in purifying the starch results in a disintegration of the starch molecule so that the resulting solution is no longer pure starch.

A compound of starch with phosphoric acid, J. Kerb (*Biochem. Ztschr., 100 (1919), pp. 3–14*).—On treating a solution of soluble starch with calcium carbonate followed by phosphorus oxychlorid in chloroform, concentrating the solution, and adding alcohol, a calcium salt of a starch phosphoric acid was precipitated. This did not hydrolyze readily with HCl, but on treatment with taka-diastase yielded a hexose monophosphoric acid fermentable by yeast.

Cellulose and its esters: Their industrial application, L. Clément and C. Rivière (*La Cellulose et les Éthers Cellulosiques leurs Applications Industrielles. Paris: Libr. Polytech., 1920, pp. [1]+III+356, figs. 66*).—This volume deals with the chemistry and technology of the various esters of cellulose, particularly cellulose acetates.

The occurrence of saponin in dried extracted cossettes, A. Traegel (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 777, II, pp. 449–459; abs. in Chem. Abs., 15 (1921), No. 2, p. 323*).—Evidence is presented that saponins occur in appreciable amounts in extracted beet pulp as well as in the diffusion juice. The proportion of saponin in the juice and in the remaining cossettes has not been determined.

A review of recent work on enzym action, R. J. S. McDowall (*Sci. Prog. [London], 15 (1921), No. 59, pp. 406–434*).—This review and discussion of recent literature on enzym action covers the period of 1910–1919.

Contribution to the chemical nature of enzyms, T. Bokorny (*Biochem. Ztschr. 100 (1919), pp. 100–113, fig. 1*).—A comparison of the alkyl amid nitrogen and total nitrogen content of various commercial enzyms with corresponding figures for certain proteins is reported, the results of which are thought to indicate that these enzyms are of the nature of proteins. The percentage of alkyl amid nitrogen or nitrogen evolved by HNO_2 was as follows: Pepsin 3.16, emulsin 4.417, diastase 4.9, rennet 3.05, taka-diastase 3.5, papayotin 7.66, egg albumin 3.281, casein 5.93, somatose 6.47, and Witte's peptone 12.4. Total nitrogen determinations include pepsin 14.44, diastase 15.3, egg albumin 16.6, casein 15.7, and konglutin from almonds 18.4 per cent.

Pectase action, H. Euler and O. Svanberg (*Biochem. Ztschr., 100 (1919), pp. 271–278*).—The juices of black and red currants and gooseberries (*Ribes*

nigrum, *R. rubrum*, and *R. grossularia*), were found to have H-ion concentrations of pH=2.96, 2.8, and 2.91 to 2.87, respectively. By partially neutralizing these juices with NaOH the optimum acidity for pectase action was found to be at pH=4.3. The action of pectase was found to be nonspecific for the three varieties tested.

The determination of H-ion concentration by means of indicators, L. MICHAELIS and A. GYEMANT (*Biochem. Ztschr., 109 (1920), pp. 165–210 figs. 9*).—The method described differs from other indicator methods of determining H-ion concentration in that no buffer solutions are required and that the determinations can be made at any temperature up to 37° C. The principle involved is that if a single-colored indicator such as phenolphthalein or nitrophenol, but not litmus or methyl orange, is added to a solution the depth of color will be somewhere between the absence of color of the acid and the extreme depth of color of the base, and that consequently at definite H-ion concentrations definite depths of color will be produced. The technique is essentially as follows:

To 5 or 10 cc. of the solution to be tested is added from a pipette sufficient indicator to produce quite a deep color. In a similar beaker is placed 4 or 9 cc. of N/100 NaOH and the indicator added until the same depth of color is obtained, after which, if necessary, more alkali is added to make the volume the same as that of the unknown solution. The H-ion concentration is then calculated from the equation $pH=pK+\phi$, where K is the dissociation constant of the indicator at the given temperature and ϕ is a function of the difference in the amount of indicator used in the unknown and standard solution (F) expressed by $\frac{\log F.}{1-F}$

Indicators practical for the method include saturated solutions of α and β dinitrophenol, 0.1 per cent solution of *p*-nitrophenol, and 0.3 per cent solution of *m*-nitrophenol. Tables are given of the dissociation constants of these and other indicators at different temperatures, the function ϕ corresponding to various values of F, and other data of value in the determination.

Determination of the reaction of culture media by measurement of the H-ion concentration, A. PONSELLE (*Bul. Inst. Pasteur, 18 (1920), No. 18, pp. 601–610, fig. 1*).—This is a brief discussion of the application of the colorimetric method of determining H-ion concentration to the adjustment of culture media. A list of 17 literature references is appended.

The determination of the reaction of bacteriological culture media, J. MCINTOSH and W. A. M. SMART (*Brit. Jour. Expt. Path., 1 (1920), No. 1, pp. 9–30, figs. 5*).—As the result of an examination of various methods of adjusting the reaction of bacteriological media, the authors recommend for ordinary routine purposes the titration of a small volume with thymolphthalein as an indicator to the so-called neutral point corresponding to the first perceptible darkening observed on the addition of alkali, the titration being carried out in the cold. From the results obtained, the alkali required to be added to the remainder of the medium can be calculated and added, and the final reaction adjusted by the addition of *n* HCl to a reaction corresponding to that of plasma or pH=7.6.

Data are presented showing that in a given medium of known original reaction there is a constant relation between the pH and the amount of acid added. Graphs illustrating this for ordinary and double strength broth are presented by means of which the H-ion concentration of the broth can be calculated from the amount of acid added. For controlling the final reaction two 3 cc. samples of the medium are diluted in test tubes with an equal bulk of dis-

tilled water. To one tube is added 2 drops of 0.5 per cent alcoholic solution of phenolphthalein and to the other 2 drops of 0.02 per cent aqueous solution of cresol red. If the reaction is correct no color change should occur in the first and a rose or pinkish color in the second tube. A pink color in the first tube indicates that the medium is too alkaline and a brown color in the second tube too acid. The error in either direction is adjusted by the addition of a few drops of N NaOH or HCl to the medium in bulk and the control test repeated.

The determination of nitrate nitrogen with copper-magnesium alloy, T. ARND (*Ztschr. Angew. Chem., 33 (1920), No. 96, Aufsatz., pp. 296–298; abs. in Chem. Abs., 15 (1921), No. 4, p. 487*).—In answer to questions that had arisen concerning the application of the method of determining nitrate nitrogen previously described (E. S. R., 42, p. 205), the author reports the results of practical tests of the method under varying conditions. Chlorids and difficultly soluble sulphates, even when present in considerable amounts, were found to have no influence on the determination. Soluble sulphates were found to affect the results unfavorably, but this was easily corrected by the addition of more magnesium chlorid. The use of 50 cc. instead of 5 cc. of the magnesium chlorid for 0.5 gm. of nitrogen is, therefore, recommended with an increase in the copper-magnesium alloy to at least 5 gm. The fineness of division of the alloy was found to have no effect on the results.

The determination of cyanamid nitrogen in calcium cyanamid, H. NEUBAUER (*Ztschr. Angew Chem., 33 (1920), Nos. 82, Aufsatz., pp. 247, 248; 84, Aufsatz., pp. 254–256; abs. in Chem. Abs., 15 (1921), No. 4, pp. 487, 488*).—For estimating the available nitrogen in commercial fertilizers containing calcium cyanamid, the author recommends the following method:

One gm. of the finely divided material is extracted with 100 cc. of acetone in successive 20 cc. portions to remove dicyanamid, urea, and free cyanamid. The residue is then treated in a flask provided with a reflux condenser with 3 gm. of Arnd's magnesium-copper alloy, 5 cc. of 20 per cent $MgCl_2$ solution, and 15 cc. of glacial acetic acid. After 10 minutes the condenser and flask are washed down with distilled water, an additional 3 gm. of the alloy is added, and the reaction allowed to proceed for 10 minutes longer, after which the condenser is again washed down, the solution diluted to 300 cc., an excess of sodium hydroxid added, and the ammonia distilled into standard acid.

To recover the acetone it is shaken with oxalic acid to neutralize the ammonia present, distilled at a temperature not exceeding 58° C., dried over potassium carbonate, and again distilled. The nitrogen in the acetone extract may be determined by the Kjeldahl method in the residue after the acetone distillation. Nitrogen which has been retained by free carbon in the original sample may be determined in the residue from the original ammonia distillation.

Iodic acid as a microchemical reagent for soluble and insoluble compounds of calcium, strontium, and barium, G. DENIGES (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 17, pp. 996–998*).—The author suggests the use of a 10 per cent solution of iodic acid as a means of distinguishing between calcium, strontium, and barium in minute amounts of their salts.

A grain of the salt to be tested is pulverized and mixed on a glass plate with a drop of water. To this is added a drop of the iodic acid solution. Examined under the microscope characteristic crystals are noted, pointed octahedra for calcium compounds, shorter octahedra with rhombic prisms for strontium, and sharp needle-like prisms grouped in sheaths for barium.

Determination of fats in cereal products, raw or cooked, and its application in determining flour grades, B. R. JACOBS and O. S. RASK (*Oper. Miller, 26 (1921), No. 2, p. 35*).—In the method described 5 gm. of the sample is

digested in a 200 cc. Erlenmeyer flask for 2 minutes on the steam bath with a mixture of 10 cc. of 95 per cent alcohol, 2 cc. concentrated ammonia, and 3 cc. of water. After cooling, the contents of the flask are digested with three successive portions of ethyl ether, after which the entire process is repeated. The combined ether extracts are evaporated to dryness on a steam bath, the fat is extracted from the residue with a mixture of equal parts of ether and low boiling petroleum ether, and the extracts are collected in a tared beaker, evaporated to dryness on a steam bath, dried at 100° C. for an hour, cooled in a desiccator, and weighed.

Data on the percentage of fat recovered by this and the direct ether extraction methods indicate a greater recovery with the former method.

The detection of methyl anthranilate in fruit juices, F. B. Power (*Jour. Amer. Chem. Soc., 43 (1921), No. 2, pp. 377–381*).—The author at the Bureau of Chemistry, U. S. Department of Agriculture, has devised a method for detecting methyl anthranilate in grape juice and other fruit juices. The essential features of the process consist in the distillation of the fruit juice with steam, using 500 cc. of the liquid and collecting about 200 cc. of the distillate, and the extraction of the distillate with three successive portions of 10 cc. each of chloroform, after which the extract is evaporated on a water bath, the residue treated with 2 cc. of 10 per cent sulphuric acid, and the solution transferred to a test tube. The liquid is then diazotized and tested with a solution of β-naphthol, prepared by dissolving 0.5 gm. of pure β-naphthol in 2 cc. of a 10 per cent solution of NaOH and diluting the liquid to 100 cc. On adding 1 cc. of this solution, 1 cc. of a 10 per cent solution of NaOH, and 1 cc. of a 10 per cent solution of monohydrated sodium carbonate to 2 cc. of the diazotized liquid a yellowish-red precipitate is produced if not less than 0.001 gm. of methyl anthranilate is present.

Milk and hemolysis, H. Violle (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 18, pp. 1078, 1079*).—The author states that normal milk, undiluted or diluted by the addition of distilled water to about three-tenths of its volume, does not hemolyze red blood cells, while milk altered by the addition or subtraction of any of its normal components or by the action of foreign substances rapidly hemolyzes red cells. The test is suggested as a rapid means of detecting abnormality in milk samples, although it does not indicate the nature of the abnormality.

Sour milk samples and Gerber's fat method, F. E. Day (*Analyst, 45 (1920). No. 536, pp. 411, 412*).—The author notes that the use of the Gerber method for determining the fat content of milk is apt to give very misleading results with sour milk owing to the formation of amyl esters of the lower aliphatic acids. Determinations on milk to which small amounts of acetic, butyric, and lactic acids had been added and on spontaneously soured milk of various ages are reported. Lactic acid had apparently no effect, acetic a slight, and butyric a decided effect upon the fat determination, the results in the last two cases being higher than those of the controls.

The chemistry and analysis of drugs and medicines, H. C. Fuller (*New York: John Wiley & Sons, Inc., 1920, pp. IX+1072, figs. 19*).—The subject matter in this reference book on drugs and medicines and analytical procedures for their identification and quantitative determination is presented in the following general sections: General methods and crude drug assays; alkaloidal drugs, alkaloids, and medicinally allied substances; glucosids, glucosidal drugs, and natural drugs containing principles other than alkaloids; organic substances other than alkaloids and glucosids; and an inorganic section.

In each section "those characteristics of the different substances valuable for their analytical significance have been detailed, many new, important, and

hitherto obscure reactions have been recorded, and wherever reliable quantitative methods of determination and separation could be found, they have been described. In the treatment of the individual drugs and medicinal agents considerable space has been devoted to detailing the character of the remedies in which they commonly occur, and the combinations usually found in practice."

In assembling the material the literature during the past 20 years has been reviewed and where utilized has been noted by literature references. Tables useful in the analytical procedures are assembled at the end of the volume.

A cryoscopic method for the estimation of sucrose, H. H. DIXON and T. G. MASON (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1920), No. 1, pp. 8*).—The authors suggest a cryoscopic method for the estimation of sucrose in small amounts of fluids, and describe the technique of such a method as applied to plant sap.

The plant material is frozen to render the tissues permeable, and the sap is extracted by pressure between two silver disks and collected in test tubes surrounded by ice. Fifteen cc. of the sample is then boiled in a test tube under a reflux condenser for one minute to destroy the enzyms, filtered into two test tubes (5 gm. into each), and immersed in a freezing liquid at —2° C., and 0.33 gm. of invertase solution added to each tube. The freezing point of the liquid is determined, after which the tubes are allowed to stand over night at 28° and the freezing point is again determined. From the difference in the observed depressions before and after inversion, the concentration of sucrose is determined on the assumption that the freezing point depression of sucrose is exactly doubled on inversion.

The method, which is said to have a possible error of 0.0016 gm., is recommended particularly for work in relation to the osmotic pressure in plants, and for sucrose determinations in any plant material in which preliminary treatment for the purpose of clearing the sap of gums, etc., would be required in the polarimetric or copper methods.

Studies on blood sugar—effect of blood constituents on picrate solutions.—A consideration of the limitations of the modified Lewis-Benedict test, D. M. COWIE and J. P. PARSONS (*Arch. Int. Med., 26 (1920), No. 3, pp. 333–342*).—The criticisms of Maclean (E. S. R., 41, p. 505) and De Wesselow (E. S. R., 41, p. 506) of the reliability of the Lewis-Benedict picric acid method for determining blood sugar led to an examination of the effect of various substances on this determination, the results of which may be summarized as follows:

Oxalation produced no difference in the reaction of normal and diabetic blood. Uric acid, ammonia nitrogen, and several amino acids were also without effect. Creatinin, acetone, adrenalin, and diacetic acid reacted to picrate solutions, the limit of picrate sensitiveness in blood to creatinin being 4, acetic acid 50, acetone 500, and adrenalin 1,000 times greater than to glucose.

In discussing these results it is pointed out that while under normal conditions these substances may not interfere with the established normal range for this method, under pathological conditions several may exert a marked influence. The question is raised as to whether the acetone bodies of the blood do not contribute to the established normal blood sugar range for the Lewis-Benedict test, and whether adrenalin may not induce a so-called hyperglycemia without mobilizing the glycogen stores of the liver.

Manufacture of sugar cane sirup on small scale (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pt. 1, pp. 214–217*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of brief directions for making small quantities of sugar-cane sirup. The methods are essentially the same as those used for the manufacture of sorghum sirup on a small scale as discussed in Farmers' Bulletin 477 (E. S. R., 26, p. 512). The chief difference

in making the sirup from sugar cane and from sorghum lies in the fact that in sorghum cane there is considerable starch which is expressed with the juice and should be allowed to settle before the juice is run to the evaporator, while the sugar-cane juice does not require settling.

The utilization of waste molasses in the Philippine Islands, with special reference to the haciendas of Negros, H. J. CARSTEN (*Philippine Jour. Sci., 17 (1920), No. 4, pp. 395–407*).—A brief description of methods for the disposal of waste molasses.

The dry distillation of extracted cossettes, W. PAAR and A. STARKE (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 777, II, pp. 445–449; abs. in Chem. Abs., 15 (1921), No. 2, p. 323*).—In an effort to determine the cause of explosions sometimes occurring in cossette drying plants, the authors subjected samples of the cossettes to destructive distillation at from 500 to 600° C. and obtained gases forming an explosive mixture with air. The necessity of a careful control of drying process to prevent overheating is emphasized.

Gur making from the juice of the date palm (Phoenis sylvestris) in the Thana district of the Bombay Presidency, V. G. PATWARDHAN (*La. Planter, 66 (1921), No. 12, pp. 190, 191*).—Experiments conducted at Sanjan and Tadgaum in the Thana district of Bombay on improvements in the methods of making gur or sugar from date palm juice are briefly reported.

The juice used for gur making was always the night collection as the day collection rapidly fermented. The best results were obtained by using formalin to prevent fermentation of the juice during its collection, and by adding to the juice before boiling one-fourth of the amount of citric acid required to neutralize the alkalinity of the original juice.

Vinegar studies, W. G. SACKETT (*Colorado Sta. Rpt. 1920, pp. 22, 23*).—Attempts to make good vinegar from molasses, sugar, and water with the use of "vinegar bees" gave variable results, while with pure yeast cultures very satisfactory molasses vinegar could be prepared in from 6 to 8 weeks. A test of the possibility of utilizing waste cantaloups from the seed-producing sections of the State for vinegar showed that fresh cantaloup juice does not contain sufficient fermentable sugar to produce the alcohol necessary to make marketable vinegar. The possibility is suggested of concentrating the juice to a point at which the sugar content would satisfy the requirements of a vinegar stock.

Report of vinegar investigations, Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 243–252*).—The results of these investigations have been essentially noted from another source (E. S. R., 43, p. 115).

Utilization of apple surplus, L. STANLEY and O. DAVIS (*Missouri Sta. Bul. 179 (1921), p. 37*).—The authors report that apple sauce, either with or without spice but with no sugar, can be dried into compact form in an oven at low temperature or in a current of heated air. On adding water and sugar and boiling for 3 or 4 minutes the resulting product is said to be very palatable and to have no dried-apple flavor.

Commercial utilization of grape pomace and stems from the grape-juice industry, F. RABAK and J. H. SHRADER (*U. S. Dept. Agr. Bul. 952 (1921), pp. 24, figs. 10*).—This publication deals with the possibility of practicable and profitable commercial utilization of the waste from grape-juice factories. Methods are described for utilizing the stems as a source of cream of tartar, the skins for jelly, and the seeds for the manufacture of oil, meal, and tannin extract. Statistics obtained from grape-juice manufacturers of the eastern part of the country showed that the average quantity of grapes crushed for beverage purposes from 1914 to 1918 inclusive was 22,000 tons, and that an average of 660 tons was discarded in stems and 4,400 in wet pomace consisting of 75 per cent skins and 25 per cent seeds. From the above quantity of waste,

it is calculated that 13.2 tons of cream of tartar, 19,800,000 8-oz. glasses of jelly, and 1,435 tons of dry residue of value as stock feed could be obtained annually. From the seeds about 89.3 tons of oil can be obtained by the pressure or expeller method, with 526.7 tons of oil cake and 48.4 tons of tannin extract. By the solvent extraction method the yield would be about 132 tons of oil and 963 tons of meal. The oil on refining is said to be a palatable edible product.

The costs and returns of the utilization of the waste as thus described have been calculated on prices prevalent during the winter of 1919–20.

Methods used in manufacturing unfermented grape juice, C. H. CAMPBELL (*Canner, 51 (1920), Nos. 9, pp. 35, 36; 10, pp. 35, 36*).—A brief description is given of the various steps in the process of manufacturing Concord grape juice, together with analyses of juices from Concord, Ives, and Clinton grapes, of argol, and of grape pomace.

Flour milling and the cereal chemist, R. W. MITCHELL (*Chem. Age [New York], 29 (1921), No. 3, pp. 85–89, figs. 2*).—This paper outlines briefly the functions and duties of the cereal chemist.

Plantation rubber and the testing of rubber, G. S. WHITBY (*London and New York: Longmans, Green & Co., 1920, pp. [3]+XVI+559, pls. 8, figs. 48*).—This volume, which is one of the series of monographs on industrial chemistry edited by E. Thorpe, deals with the preparation and testing of plantation rubber. Data on the yearly world production of rubber, both plantation and wild, from 1906 to 1917 are presented in tabular form and also represented graphically, with the estimated annual percentage increase in the area of plantation rubber in bearing through 1922. An extensive bibliography is appended.

METEOROLOGY.

Meteorological tables, D. A. SEELEY (*Mich. State Bd. Agr., Ann. Rpt. Sec. 58 (1919), pp. 143–156*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1919.

[Temperature and rainfall at McNeill, Miss., Substation, 1903–1917], E. B. FERRIS (*Mississippi Sta. Bul. 188 (1920), p. 23.*)—A table is given which shows the maximum and minimum temperature and rainfall of each month for the 15 years 1903–1917.

Climatic conditions [at Edgeley Substation, N. Dak.], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921). pp. 3–8*).—Climatic conditions with reference to crop production at this place during the years 1914 to 1920, inclusive, are briefly described, and data for precipitation and temperature for each month from 1901 to 1920, inclusive, are summarized in tables. Data on evaporation as compared with precipitation during May, June, and July, 1907–1920, are also tabulated.

The data show that evaporation ranged during the growing months from an amount about equal to the precipitation in favorable seasons to slightly more than 30 times the precipitation in a dry hot period. "It has been observed that crop production very closely follows the relative ratio of evaporation to precipitation."

Analysis of the air of Sao Paulo, Brazil, B. DE MATTOS FILHO (*Bol. Agr. [Sao Paulo], 21. ser., No. 12 (1920), pp. 821–846, figs. 8*).—The ozone, carbon dioxid, and moisture contents of the air of each day of July, August, and September, 1920, are reported.

British rainfall, 1919 [*(Gt. Brit.] Met. Off., Air Min., Brit. Rainfall Organ., 59 (1919), pp. XXVIII+268, pls. 2, figs. 36; rev. in Met. Mag. [London], 55 (1921), No. 660, pp. 269, 270*).—This report summarizes in practically the same form as in previous years the results of 4,896 complete rainfall records. It also contains special articles on The Effect of Rainfall on the Saturation-Level in the Chalk at Chilgrove, West Sussex, from 1836 to 1919, by D. H. Thomson, and on The Exposure of Rain Gauges, by M. de C. S. Salter (E. S. R., 44, p. 209), a record of evaporation and percolation in 1919 at various places, and a discussion of the relation of evaporation records at Camden Square, from 1905 to 1918, to other meteorological elements. The distribution of rainfall is as usual considered at length, and a new feature of the report is the introduction of maps showing the distribution of the annual rainfall.

"It would appear to be abundantly clear that sunshine and temperature are the prime factors in promoting evaporation, any modification introduced by variations in the wind movement and rainfall being too slight appreciably to affect the high correlation."

SOILS—FERTILIZERS.

The chemical composition of the soils of the Camden area of New Jersey, A. W. Blair and H. C. McLean (*New Jersey Stas. Bul. 346 (1921), pp. 40, figs. 2*).—Chemical analyses of samples of the different soil types encountered in the Camden area of New Jersey, the physical survey of which has been previously noted (E. S. R., 37, p. 123), are reported and discussed.

It is stated that there are rather pronounced chemical differences between the soils of the different soil series encountered within the area. The Collington, for example, is characterized by the presence of more or less greensand marl and therefore contains a rather high percentage of potash, the Keansburg shows an unusually high percentage of all three fertilizing constituents, and the Freneau is high in phosphoric acid and potash. In the Shrewsbury the potash is notably higher in the subsoil than in the soil. The Hyde shows an exceptionally high percentage of nitrogen and also an excess of lime over magnesia. The Sassafras, on the other hand, usually shows an excess of magnesia over lime. The Lakewood is characterized by a pronounced deficiency in all three fertilizing constituents, in some cases only a trace of potash being reported. The soils of all series are deficient in available lime.

Generally speaking, those soils which contain the highest percentage of total plant food are those that are most productive and command the highest prices as farm lands. Exceptions to this are found in the poorly drained, heavy clay soils, and those that are highly acid. Following from the lighter to the heavier types through the different series, there is to be noted in general a gradual increase in the total plant food. There is invariably more nitrogen in the soil than in the subsoil. In most cases the amount in the former is at least two or two and a half times that in the latter. When averages are considered the difference between the mineral plant food content of the soil and the subsoil is not great, though in a number of cases there is more potash in the subsoil than in the soil.

The loams throughout the area are high in potash, the amount varying from 1 to as much as 4 per cent, with an average of 1.63 per cent for the soil, 1.9 per cent for the first subsoil, and 1.91 per cent for the second subsoil. With the exception of the Shrewsbury series the sands and sandy loams usually contain less than 1 per cent of potash.

Composition of the sugar-cane soils of the French Antilles, M. Rigotard (*Agron. Colon., 6 (1921), No. 38, pp. 44–52*).—Physical and chemical analyses

of typical samples of sugar cane soils of the French Antilles are summarized and discussed.

The physical analyses show that most of these soils are either red or yellow siliceous clays and are very deficient in lime, but have a limy subsoil. The chemical analyses show that while the soils contain important total amounts of nutritive constituents, only a small percentage of these is available to crops, especially phosphoric acid.

[Plowing and subsoiling experiments at the Edgeley Substation], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 20–22*).—The results of eight years' trials of different methods of preparing land for a crop are reported. A continuous cropping system was used, and the only varying factors were the different methods of preparation. These included early fall plowing done near September 1, medium fall plowing done near October 1, late fall plowing done near November 1, and spring plowing and disking. In some cases the subsoil packer was used, and in other cases the soil was disked in the fall and plowed in the spring.

A comparison of the average yield from all the fall methods of tillage with the average of all the spring methods showed a difference of 3.2 bu. of wheat per acre in favor of the latter. Crops on the early fall plowed land gave the best yields, those on spring plowed land second best, and those on medium and late fall plowed land third best. Apparently no advantage was obtained from packing the land either in the fall or in the spring for cereal crops, and the indiscriminate use of the subsurface packer is not recommended.

In experiments in subsoiling and packing as methods of preparing the soil for durum and hard wheat, oats, and barley, it was the plan to subsoil the land once every four years in the subsoil plats and to fall plow the land 6 in. deep in all plats the remainder of the time. The average of six years' trials indicate that packing and subsoiling were of no benefit. Good 6-in. plowing gave as good yields as were obtained with 6-in. plowing plus subsoiling and 6-in. plowing plus subsoiling and packing.

[Soil bacteriology] (*Idaho Sta. Bul. 122 (1921), pp. 27, 28*).—Studies of Helmer silt loam soil from northern Idaho, which is deficient in ammonifying, nitrifying, and nitrogen-fixing powers, showed that the ammonifying and nitrifying efficiencies were increased approximately 400 per cent by the addition of 1 per cent of calcium carbonate.

Sawdust from kiln-dried lumber, including white and yellow pine, cedar, maple, ash, larch, red and white fir, needles and cones from the same trees, fern brakes, and forest floor, when added to soils of known fertility, reduced the ammonification of dried blood from 12 to 20 per cent. The retarding action was not entirely overcome by the addition of lime during the period of the experiment.

Samples of the same sawdust were added to a rich garden soil and a field soil to determine the effect on the nitrifying of blood. The result with the garden soil showed a reduction in nitrate formation varying from 17 to 24 per cent. The reduction in the case of the field soil varied from 5 to 49 per cent in the presence of 1 per cent of wood and from 5 to 78 per cent in the presence of 2.5 per cent of wood. Cedar persistently exerted the greatest retarding influence. Of the various products added, fern brakes caused the least reduction in nitrate formation, which varied from 4 to 11 per cent, while cedar needles proved the most toxic, reducing nitrate formation from 32 to 76 per cent.

These results are taken to indicate that the lack of productivity of Helmer silt loam is due to the accumulation of by-products from the forest which exerts an unfavorable influence on bacterial activities. Studies of the effects of woods and forest products on nitrogen fixation, in which something like a

thousand Kjeldahl nitrogen determinations were made, showed that all conifers have an inhibitory action upon the nitrogen-fixing powers of soil bacteria, cedar being the most deleterious, followed by red fir, larch, and white and yellow pine. With age and the starting of decomposition processes this toxicity was materially reduced. Ash and maple stimulated the fixation of free nitrogen. Concentrations of cedar needles as low as 0.1 per cent per 100 gm. of mannite solution proved toxic, and higher concentrations practically eliminated all nitrogen fixation by bacteria.

[**Soils and soil biology**] Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 236–238*).—Experiments with a series of composts, consisting of various proportions of peat and manure on a nearly pure sand soil growing Canada field peas, showed that the pure peat gave the best results, and the yields decreased as the percentage of peat decreased. This is attributed merely to the water-holding capacity of the peat.

Studies of composts of peat, manure, and rock phosphate to which sufficient liquid manure was added to insure anaerobic conditions showed that large numbers of both aerobic and anaerobic cellulose-decomposing organisms were present and were increasing. Organisms concerned in the dissolution of rock phosphate were present quite frequently in considerable numbers. Analyses of material from the pit showed that there had been an increase of about 8 per cent in the citrate-soluble phosphoric acid in a period of nine months, but a decrease in total phosphorus of about 20 per cent, which is accounted for by the presence of large amounts of soluble phosporus in the drainage water. Azotobacter were found not only in the surface samples but in the bottom samples, which had existed for over nine months under decidedly anaerobic conditions.

Daily periodicity in the numbers of active soil flagellates, with a brief note on the relation of trophic amoebae and bacterial numbers, D. W. CUTLER and L. M. CRUMP (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 11–24, figs. 8*).—Studies of the protozoa and bacteria in the soil of a fertilized wheat field at the Rothamsted Experimental Station are reported, which indicated that there is a daily fluctuation in the number of trophic forms of the three species of flagellates, *Oicomonas* sp. (Martin), *Cercomonas longicauda*, and *Bodo* sp., in the soil of arable fields. The numbers of bacteria and trophic amoebae in the soil were found to be correlated, varying inversely over a period of 14 days. Temperature and rainfall appeared to have no influence on the numbers of active protozoa in the soil.

Bacteriological studies of alkali soils, W. G. SACKETT (*Colorado Sta. Rpt. 1920, p. 21*).—Studies of the bacteria from the Book Cliff and Mesa Verde sandstones to determine their ability to fix atmospheric nitrogen, both in pure cultures and when associated with one another, showed that although the amount of nitrogen fixed is small, the fixation is consistent. Associative action appears to be of no importance in this process. Rock lichens were shown to be capable of satisfying all carbon requirements. Fourteen pure cultures and their combinations were examined in this study.

The natural inoculation of Colorado soil with legume bacteria, W. G. SACKETT (*Colorado Sta. Rpt. 1920, p. 22*).—Representative samples of Colorado soils from both dry and irrigated sections were planted with numerous different legumes, and after six weeks the plants were examined for nodules. Tests of 45 soils have given results indicating tentatively a rather general and natural inoculation for alfalfa, sweet clover, and vetch and the need of inoculation for peas and beans.

Acidity influences inoculation and growth (*Wisconsin Sta. Bul. 323 (1920), p. 55, fig. 1*).—Studies by O. C. Bryan and E. B. Fred showed that cowpeas and

soy beans dropped off markedly in both growth and nodule formation as soon as an excess of either acid or alkali appeared in the soil. Corn, on the other hand, made a reasonably satisfactory growth even under acid conditions which were sufficient to stunt and prevent the inoculation of the roots of both soy beans and cowpeas.

Are legume bacteria killed by freezing? (*Wisconsin Sta. Bul. 323 (1920), p. 36*).—Experiments conducted by E. B. Fred indicated that legume bacteria are able to live through the winter and will withstand winter temperatures, and also that bacteria planted with the seed in early spring will be able to induce nodule formation.

Nitrate production in field soils in Illinois, A. L. Whiting and W. R. Schoonover (*Illinois Sta. Bul. 225, abs. (1920), pp. 4*).—This is an abstract of Bulletin 225 of the station, previously noted (E. S. R., 43, p. 214).

Green manure for soil improvement (*Wisconsin Sta. Bul. 323 (1920), pp. 53–55, fig. 1*).—Experiments by A. R. Whitson and F. L. Musbach showed that the influence of the green manuring crop in a 4-year rotation of corn, potatoes, oats, and clover is greater during years following seasons favorable to its growth. The good effect of green manure was found generally to increase when the rotation had been in progress until two or three manuring crops were added to the soil.

Studies on the relations between soil moisture, plant development, and nutrition, E. Haselhoff (*Landw. Vers. Sta., 89 (1916), No. 1, pp. 1–31*).—Preliminary studies on the subject are reported, which established the existence of narrow relations between soil moisture, nutrient assimilation, and crop yield, but apparently did not justify the drawing of specific conclusions.

Investigations on the determination of the active value of soil phosphoric acid and potash by cropping experiments and the determination of their relative solubility by acids, O. Lemmermann, A. Einecke, and L. Fresenius (*Landw. Vers. Sta., 89 (1916), No. 2–3, pp. 81–195, pls. 2*).—These studies are reported as a contribution to the basic knowledge of soil analysis, which is apparently not considered to be as yet sufficiently complete to permit the drawing of final conclusions.

It was found in these experiments that the physiologically active value of phosphoric acid and potash compounds in soils could usually be suitably expressed by a determination of their relative solubilities. Such determinations are therefore recommended for the judgment of soils, as they represent the actual value of these soil nutrients better than a simple determination of the percentage content of the soil in potash and phosphoric acid by a single solvent.

A 1 per cent solution of citric acid proved to be the best solvent for determining the relative solubility of soil phosphoric acid. This solvent was too weak for potash, better results being obtained with 10 per cent hydrochloric acid. It was possible to disregard the influence of the physical character of the soil in the method used. Also in comparing the solubilities of nutrients in light and heavy soils, it was found that the potash compounds of the better soils were not more difficultly soluble than those of the lighter soils. The opposite was true for phosphoric acid, which is attributed to the higher percentages of iron and clay in the better soils. Crops appeared to utilize phosphoric acid relatively better from soils more deficient in that nutrient.

Soil-fertility experiments on Dekalb, Volusia, and Westmoreland soils, J. W. White and F. J. Holben (*Pennsylvania Sta. Bul. 166 (1921), pp. 23, figs. 5*).—The nature, objects, scope, and progress results of soil-fertility experiments being conducted on three typical soils of Pennsylvania are presented in this report. The experiments are intended to test the comparative

value of different forms, combinations, and amounts of commercial fertilizers, lime, and manure in the production of the more common farm crops grown in the State. The three series of experiments at present include 18.4 acres divided into 152 plats.

It has been found that acid phosphate is the most effective single fertilizer treatment for the unproductive Dekalb soil, and together with lime it appears to be the foundation for a system of permanent agriculture on this extensive soil area. On the basis of equal amounts of phosphoric acid, acid phosphate during the first rotation was found to be over five times as effective as rock phosphate. The first two years' results on the Volusia soil indicate that lime is indispensable in the scheme of soil improvement, since 90 per cent of the Volusia soils are acid. The utilization of the manure from the dairy industry to the best advantage is considered to be of first importance on this soil, and the increased value of manure through the use of lime and phosphoric acid has been demonstrated. No definite recommendations are given for the Westmoreland soil.

Soils (*Missouri Sta. Bul. 179 (1921), pp. 49–55, figs. 4*).—The results of 30 years of crop rotation and fertilizer experiments are summarized by M. F. Miller and F. L. Duley, showing that crop rotation on corn has been more effective in maintaining the yield where no manure has been applied than has continuous corn with manure. The same result was obtained with wheat. It is also noted that heavy applications of commercial fertilizers have been practically as effective in maintaining the yield of wheat under continuous cropping, and the yield of all crops in a 6-year rotation, as has the heavy use of stable manure.

Experiments to determine the best systems of soil management for the most important soil types in Missouri, conducted by M. F. Miller, F. L. Duley, and O. B. Price, showed that the so-called legume treatment has brought no financial returns, and that rock phosphate applied with manure has given good results on certain fields of wheat. The small response from other crops, however, has made this application uneconomical.

Studies of nitrate production in soil as affected by cropping and cultivation were continued by W. A. Albrecht, showing that early spring tillage, particularly plowing, increased the nitrate content. Of all treatments studied, the straw mulch produced the most significant effects in holding down nitrate production.

Report of the Golden Valley peat experimental fields, 1918 and 1919, F. J. Alway (*Minnesota Sta. Bul. 194 (1920), pp. 5–116, figs. 37*).—The results of the first two seasons' work on the experimental peat fields of Golden Valley, which are typical of the high-lime, grass, and sedge-covered bogs of northwestern Minnesota, are reported.

It has been found that the unproductivity of this peat is due to a lack of available phosphoric acid. When this was supplied, good yields of most crops adapted to that section of the State have been obtained, otherwise only flax gave satisfactory yields. The natural supply of lime is abundant, and the nitrogen becomes available rapidly enough for ordinary farm crops. During the first two years potash showed no distinctly beneficial effects either alone or in combination with phosphate. The burning of the surface layer of peat to provide phosphoric acid, while possible, is not recommended owing to the many disadvantages and danger connected with the practice.

It is recommended that farmers who have peat land naturally covered with grass use a phosphate fertilizer containing either from 300 to 400 lbs. per acre of acid phosphate or one-third as much of triple superphosphate.

Experiments on maintaining soil fertility on Edgeley loam [at the Edgeley Substation], O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 38, 39*).—A set of crop rotations begun in 1913, which were designed to determine the profitableness of a live-stock farming system and a cash-crop farming system, is described and the results to date reported.

In the live-stock system a 4-year rotation, consisting of corn, wheat, oats, and sweet clover, was used and manure and commercial fertilizers applied. The cash-crop farming system included a rotation of potatoes, wheat, barley, and sweet clover, and green manure and commercial fertilizers were applied. It was found that as an average of seven years, manure alone increased the yield of corn 0.45 ton per acre, or 17.3 per cent. As a 6-year average, manure increased the yield of wheat 1 bu., or only 6.5 per cent. The influence of soil treatment on the yield of oats was negligible. There was no evidence that the use of commercial fertilizers produced any increase over and above that produced by manure. As an average of eight years, green manuring increased the yield of potatoes 8.3 bu. per acre, or 8.9 per cent.

[Soil investigations], F. J. SIEVERS (*Washington Sta. Bul. 158 (1920), pp. 33, 34*).—Soil-fertility studies in western Washington indicate conclusively that most acid soils are deficient in phosphorus, and that application of lime alone generally gives poor results unless it is supplemented with a phosphate fertilizer. Indications are that much of the difficulty experienced in growing clover is due more to the deficiency in phosphorus than to soil acidity.

Data from crop rotation work show that peas can be used to good advantage as a nurse crop for alfalfa and sweet clover.

Studies of orchard soils showed that in all the irrigated tracts there must be sufficient water available not only to supply the quantity necessary for bearing trees, but also to provide for the growing of a legume between the trees. The virgin nitrogen supply in irrigated orchard tracts is said to be exceedingly low, and successful yields depend upon the maintenance and increase of this supply.

A complete fertilizer for Savannah cranberry land, C. S. BECKWITH (*New Jersey Stas. Circ. 124 (1921), pp. 4, fig. 1*).—Studies to determine proper fertilizer treatment for cranberry soils are briefly reported and discussed.

It was found that sodium nitrate and dried blood were the best sources of nitrogen, while ammonium sulphate and calcium cyanamid were undesirable. Raw rock phosphate and acid phosphate both gave good results. Potash gave small increases and seemed most advantageously applied as potassium sulphate. On the basis of these results, information is given for popular use on the proper fertilizer formula to be used on such soils.

New way for the use of sewage sludge as fertilizer, M. STRELL (*Landw. Vers. Sta., 90 (1917), No. 3–4, pp. 257–268*).—Experiments are reported, the results of which are taken to indicate that the nitrification of the organic nitrogen compounds of sewage and stable manure is hastened by mixing certain humus-containing substances with them. In this connection the author describes his experience with a brown coal humus product mixed with canal sewage.

Is phonolite a nitrogeneous fertilizer? E. BLANCK (*Landw. Vers. Sta., 90 (1917), No. 1–2, pp. 33–47*).—Experiments are reported from which the conclusion is drawn that phonolite does not act as a nitrogenous fertilizer.

Recovery of potash alum and sulphur at Tonopah [Nev.], L. DUNCAN (*Chem. and Metall. Engin., 24 (1921), No. 12, pp. 529, 530, figs. 4*).—The process and plant used in the recovery of potash alum and an agricultural grade of sulphur by extraction and flotation are described.

The solubility of different phosphates and their utilization by oats and buckwheat, T. Pfeiffer, W. Simmermacher, and M. Spangenberg (*Landw. Vers. Sta., 89 (1916), Nos. 2–3, pp. 203–230 pl. 1*).—The results of a continuation of experiments previously noted (E. S. R., 35, p. 428) confirmed those of the first experiments, and showed that an addition of calcium carbonate decreased the utilization of difficultly soluble phosphates. Raw phosphate proved to be a good fertilizer on acid soils. Buckwheat, while having a weaker root system than oats, again assimilated more phosphoric acid from difficultly soluble phosphates. An artificial introduction of carbon dioxid into the soil did not make plant nutrients more available.

A greater water utilization per unit weight of increase in dry matter took place when coral rock phosphate was used. This is thought to be possibly due to the fluorin content of the phosphate. A corresponding addition of calcium fluorid produced no results, but an addition of ammonium fluorid slightly injured the growth of oats. It is concluded that the fluorin content of the coral rock phosphate can not account for the poor results obtained from its use with oats.

Lime maintains availability of phosphates (*Wisconsin Sta. Bul. 323 (1920), pp. 55, 56*).—Experiments by E. Truog and F. W. Parker indicated the value of lime in the soil in keeping phosphates in available form. As the amount of lime in the soil decreases, conditions were found to permit the formation of the less available iron phosphates.

Laboratory trials with rape and corn showed that liming greatly increased the availability of phosphate in acid soil.

Soil fertility experiments (*North Dakota Sta. Bul. 146 (1921), p. 14*).—The progress results of a comparative study of raw rock phosphate, steamed bone meal, and acid phosphate as supplementary fertilizers in live-stock and cash-crop farming systems on Fargo clay soil showed that the acid phosphate gave somewhat more beneficial average results than either steamed bone meal or raw rock phosphate. These differences in the effects of the various forms of phosphate were small, however.

An improved scheme for determining unexhausted manurial values, J. Hendrick (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 1–34*).—The author discusses in some detail some of the important proposals contained in the report of the committee on compensation for manurial improvements and so-called cumulative fertility, appointed under the Agricultural Holdings Act of Scotland of 1908. The text of the report discussed is appended.

Liming, H. Glømme (*K. Selsk. Norg. Vels Jordbundsutvalg. Smaaskrifter No. 10 (1920), pp. 104*).—Several series of experiments to study the action of lime in soils when used in practical agriculture are described. These included work on soils varying from clays and sands to loams and peat. The proper time of liming pastures and methods of determining lime requirements were also studied. Liming generally produced increases in both potato and grain crops of clay, sand, and peat soils, but not on moraine and black soils. A bibliography is appended.

Special fertilizer analyses, 1920, R. E. Rose and G. Hart (*Fla. Dept. Agr. Quart. Bul., 31 (1921), No. 1, pp. 44–83*).—This section of this report contains the results of special analyses of 413 samples of fertilizers and fertilizer materials taken by purchasers in Florida during the calendar year 1920, and the results of official and guarantied analyses of 47 samples collected for inspection under the terms of the State fertilizer law.

[Analyses of commercial fertilizers, ground bone, and agricultural lime], C. S. Cathcart et al. (*New Jersey Stas. Bul. 349 (1920), pp. 5–45*).—This bulletin contains the results of actual and guarantied analyses of 898 samples of fertilizers and fertilizer materials and of 13 samples of lime and

limestone collected for inspection in New Jersey during the fall of 1920, together with registrations for the year.

AGRICULTURAL BOTANY.

Outline of the history of botany, R. J. HARVEY-GIBSON (*London: A. & C. Black, Ltd., 1919, pp. X+274*).—This brief sketch of the history of botany indicates the substance of a course of lectures given to students of the University of Liverpool during their third year of residence, and has for its object the discussion of the more important features in the advance of botanical knowledge from the earliest times to the present. Reference is made to contributions by about 50 authors.

The quantitative method in biology, J. MACLEOD (*Manchester: Univ. Press; New York: Longmans, Green & Co., 1919, pp. XII+228, figs. 27*).—In view of the fact that variability has been hitherto the great obstacle which has rendered impossible the general use of quantitative data (figures) in biological sciences, the author aims to describe a method by which biological constants may be established.

The first two chapters set forth certain theoretical views regarding the concepts of species and variation. These views afford a guide for the discovery of primordia, or elementary properties or characters, which are to be measured in order to find constants. The constants themselves are, however, entirely independent of any theory and of any calculation whatever, each being a direct expression of an observed fact.

Radioactivity and normal physiological function, V. H. BLACKMAN (*Ann. Bot. [London], 34 (1920), No. 135, pp. 299–302*).—A brief statement and discussion of the data obtained by H. Zwaardemaker[1] are given, in view of their supposedly fundamental importance to plant as well as animal physiologists.

It is thought possible that the importance of potassium in the life of the plant may be in part explained by its radioactive power. In the minuteness of the dose of the heavy radioactive elements required, as compared with that of potassium, and in the ease with which a toxic concentration is reached, may lie the explanation of the conflicting results obtained by the addition of radioactive earths to soil.

Plant physiology (*Idaho Sta. Bul. 122 (1921), pp. 44, 45*).—Progress reports are given of investigations on the development of the apple and on the enzymatic processes taking place in the apple at various stages in its development. Tests were made for the presence of diastase and invertase in the apple at different stages of growth, but all the results were negative.

In studying the growth of the apple it was found that the fruit is made up of a large mass of parenchymatous cells which appear to be fully formed at an early stage of its growth, and the increase in size appears to be mainly due to an enlargement of existing cells. Starch appears early in the growth of the apple and is deposited throughout the growing season. During the ripening period starch disappears, and in fully ripened apples little or no starch is to be found.

Plant growth and carbon dioxid, H. FISCHER (*Naturwissenschaften, 8 (1920), No. 22, pp. 413–417*).—This brief discussion of work in part previously reported (E. S. R., 42, p. 137) deals with the practical possibilities involved in supplying more than the normal air content of carbon dioxid to growing plants.

[1] Jour. Physiol., 53 (1920), No. 5, pp. 273–289.

Field studies of the carbon dioxid absorption of coconut leaves, F. T. McLean (*Ann. Bot.* [*London*], *34* (*1920*), *No. 135, pp. 367–389, pl. 1, figs. 9*).—The method here described for field studies of carbon dioxid absorption by leaves is considered satisfactory for comparative studies of the rates of carbon dioxid absorption by different leaves, by the same leaves at different times, and by the leaves of different kinds of plants.

Middle-aged leaves absorb carbon dioxid faster than either immature or old leaves. The rates of absorption of carbon dioxid by attached coconut leaves show a maximum rate in the morning, a depression at midday, and a second rise in the afternoon, followed by a final declination toward sunset. Detached pinnae of coconut absorb carbon dioxid at the same rate as attached leaves, but the maximum occurs at a different hour. Apparently sugar cane absorbs carbon dioxid much more rapidly than coconut under these conditions.

A method of preparation and some properties of a starch gel, C. L. Carey (*Bul. Torrey Bot. Club, 47* (*1920*), *No. 10, pp. 455–463*).—The preparation of this starch gel was undertaken with the idea of obtaining a pure carbohydrate gel which on account of its hydrative capacity would be suitable for experimentation under various conditions. This method is offered as a means of preparing a fairly resistant starch gel which is easily handled.

Osmotic properties of some plant cells at low temperatures, F. J. Lewis and G. M. Tuttle (*Ann. Bot.* [*London*], *34* (*1920*), *No. 135, pp. 405–416, figs. 10*).—Determinations have been made of osmotic pressures, electrical conductivities, proportions of electrolytes and nonelectrolytes, and of sucrose, maltose, and glucose in the leaf tissues of *Picea canadensis*, *Linnaea borealis*, and *Pyrola rotundifolia*, and in the cortical tissues of *Populus tremuloides* at intervals from autumn until summer.

It is thought that no certain correlation between the values found and the daily or weekly fluctuations of air temperatures can be established without observations extending over more than one season.

The freezing point of potatoes as determined by the thermoelectric method, R. C. Wright and R. B. Harvey (*U. S. Dept. Agr. Bul. 895* (*1921*), *pp. 7, fig. 1*).—The results are given of a study of the freezing point of 18 standard varieties of potatoes grown under the same conditions, a thermoelectric method being used for the determination.

It was found that the freezing point of potatoes tends to rise as the season advances. It seems to vary with varieties, and in the same family group of potatoes the freezing point of different varieties is often comparable. Early and mid season varieties are said to have a higher freezing point than late varieties.

Freezing injury to potatoes when undercooled, R. C. Wright and G. F. Taylor (*U. S. Dept. Agr. Bul. 916* (*1921*), *pp. 15, pl. 1, fig. 1*).—In this investigation of the injury to potatoes due to exposure to temperatures below the freezing point, it was found that potatoes freeze more quickly when exposed to rapidly diminishing temperatures than when the temperatures diminish slowly. Potatoes can be undercooled several degrees below their true freezing point, then warmed again above the freezing point without freezing injury, provided no ice formation takes place. When undercooled, jarring resulting from rough handling or incidental to hauling is liable to cause potatoes to freeze. After freezing commences it is progressive, and the amount of injury caused within a stated time is said to depend upon the surrounding temperature. In undercooled potatoes, when freezing has once begun, the temperature of the potatoes is said to rise to its true freezing point and remains at that temperature for a varying length of time, depending upon the surrounding temperature.

Uptake of water by detached twigs, T. MATSUSHIMA (*Jour. Col. Sci. Imp. Univ. Tokyo, 43 (1919), Art. 2, pp. 27, figs. 2*).—Decrease of water uptake at the cut end of a twig cut off in air is unimportant in plants which contain much woody material, but considerable in plants containing milk, slime, or gum. Burning the cut end, especially in the latter of these two general classes, favors water uptake; charring the cut end preventing entirely the stoppage of the water-carrying vessels. Acids (particularly organic) favor, while alkalis hinder, the absorption of water, these conditions being reversed in case of milk-, slime-, or gum-bearing twigs.

The growth of Lemna plants in mineral solutions and in their natural medium, W. B. BOTTOMLEY (*Ann. Bot. [London], 34 (1920), No. 135, pp. 345–352*).—Experimentation is claimed to have shown, in case of *Lemna minor* and *L. major*, that these plants are unable to sustain healthy growth for any length of time on Detmer's solution or Knop's solution, though the addition of organic matter promoted health and multiplication and accelerated growth in these plants. The organic matters thus shown to be essential to metabolism are found in the pond waters in which the plants grow normally, although lack of sufficient nitrates and phosphates acts as a limiting factor retarding multiplication.

The effect of organic matter on the growth of various water plants in culture solution, W. B. BOTTOMLEY (*Ann. Bot. [London], 34 (1920), No. 135, pp. 353–365, pl. 1*).—The results from these experiments corroborate those above noted, in that organic matters were necessary to supplement nutrient inorganic solutions.

The substances effective in promoting growth and health were found to be present in an autoclaved growth of *Azotobacter chroococcum*, crude nucleic acid derivatives from raw peat, and a water extract of bacterized peat. Other plants experimented with are said to have responded in the same general ways as did the plants above mentioned. Throughout the experiment it was found that the more rapid the rate of multiplication of the plants, the quicker was the response to the addition of organic substance to the solution.

The relation between the number of bacteria and acid production in the fermentation of xylose, J. A. ANDERSON, E. B. FRED, and W. H. PETERSON (*Jour. Infect. Diseases, 27 (1920), No. 4, pp. 281–292, figs. 3*).—This article is concerned primarily with the rate at which by-products are formed and their relation to the number of bacteria, in order to study the mechanism of fermentation reactions. The experiments described were made with *Lactobacillus pentoaceticus* in an attempt to determine the relations between the number of bacteria present and the rate of acid production during the fermentation of xylose.

The results show that the fermenting capacity of a culture is determined by the number and age of the bacteria present. The rate of acid production is most rapid during the period of maximum growth of the bacteria, though a slow acid formation is noted for many days. Apparently, acetic acid is the only volatile acid produced in the fermentation of xylose by *L. pentoaceticus*.

The biological significance of tannic substances, A. DE DOMINICIS (*Staz. Sper. Agr. Ital., 52 (1919), No. 7–9, pp. 305–331*).—This is a report of a study on the variations in the content of tannic substances, chiefly in the cortex of chestnut, at different periods. Tannic substances in the glucosid stage are supposed to represent waste products easily destroyed, and utilizing in their destruction the process of combustion in the plant.

The effect of zinc sulphate on protoplasmic streaming, H. M. RUSK (*Bul. Torrey Bot. Club, 47 (1920), No. 9, pp. 425–431, figs. 2*).—Results of this study, as carried out with leaf cells of *Elodea canadensis* and with cells from an

uncorticated Chara, are offered as evidence in favor of the view that very dilute poisons act as stimulants to plant cells.

A study of the metabolism of roots, W. J. Robbins and W. E. Maneval (*Missouri Sta. Bul. 179 (1921), p. 22*).—The authors have been carrying on investigations to determine whether any material is necessary for the growth and development of the roots of plants in addition to the essential mineral salts and water obtained from the soil solution, oxygen from the air, and carbohydrates from the plant top. A method is said to have been developed whereby the growth of root tips can be maintained under sterile conditions.

A simple root auxanometer, W. N. Jones (*Ann. Bot. [London], 34 (1920), No. 136, pp. 555–557, fig. 1*).—An auxanometer, claimed to be in practice sufficiently simple for elementary studies and at the same time sufficiently accurate for more serious purposes, is described as to form, construction, and procedure.

Studies in seed germination, A. W. Hill (*Ann. Bot. [London], 34 (1920), No. 136, pp. 417–429, pl. 1, figs. 15*).—Evidence is offered to show that the rudimentary curved body lying opposite the cotyledon in the Cyclamen embyro is the second cotyledon, and that under ordinary conditions it does not develop to form a green leaf. The Cylamen seedling, though aberrant in type, is thus seen to be truly dicotyledonous in its nature.

The rôle of the seed coat in relation to the germination of immature seed, F. Kidd and C. West (*Ann. Bot. [London], 34 (1920), No. 136, pp. 439–446, fig. 1*).—The present paper is claimed to show that in case of *Brassica alba* and of *Pisum sativum* the removal of the testa not only accelerated the germination and terminated the dormant condition of unripe seeds, but also increased the germination percentage.

Study of factors influencing the rest period of horticultural plants, H. D. Hooker, jr. (*Missouri Sta. Bul. 179 (1921), pp. 39, 40*).—Analyses were made of fruit buds that survived the winter's cold and of buds that were killed. The analyses of peach and cherry buds showed that the surviving buds had a low ether extract, but a relatively high content of nitrogen, phosphorus, and potash. Analysis of comparable samples from the peach, including the node with the bud, showed the surviving buds to have a low moisture, acidity, and nitrogen content, but a high starch content. Starch is said to be stored in the leaf gap and consequently does not figure in the analysis of buds alone.

Natural death of plants, F. Weber (*Naturw. Wchnschr., 34 (1919), Nos. 32, pp. 449–457; 33, pp. 465–471*).—Citations and discussions are presented regarding the views held by various authors, along with some of the underlying data.

Further studies in the ecotone between prairie and woodland, R. J. Pool, J. E. Weaver, and F. C. Jean ([*Nebr.*] *Univ. Studies, 18 (1918), No. 1–2, pp. 7–53, pls. 2, figs. 15; also Nebr. Univ., Bot. Survey Nebr., n. ser., No. 2 (1918), pp. 47, pls. 2, figs. 15*).—The object of this paper, which is a sequel to that by Weaver and Thiel already noted (E. S. R., 38, p. 521), is to record the results and conclusions derived from another season's investigations of some of the fundamental problems connected with the ecology of the areas lying within the vegetative borderlands between the prairies and the woodlands of the Missouri Valley in Nebraska.

"This paper contributes data which still further substantiates the conclusions drawn from previous investigations that evaporation rates and soil moisture conditions in the various plant communities studied vary in general directly with the order of the communities in succession, the communities nearest the climax being the most mesophytic in both respects. . . .

"Ecological conditions are shown to change rapidly as the forest-prairie ecotone is traversed in Nebraska. . . . It is thus shown that the natural extension of our native woodlands is greatly hindered, possibly altogether prevented in so far as any significant permanent extension is concerned, by the increasing severity of natural environmental conditions as we move westward away from the woodland types of southeastern Nebraska."

The high saturation deficit and the low soil moisture content (often reaching the nonavailable point) of the prairie sites in eastern Nebraska constitute barriers over which forest trees can scarcely pass. This gives probably the most ready explanation as to why natural Nebraska woodlands are confined to the moist slopes of rather narrow valleys, and also the most probable answer to the question as to the treelessness of the prairies in general.

Plant invasions of New Zealand with reference to Lord Howe, Norfolk, and the Kermadec Islands, J. C. WILLIS (*Ann Bot. [London], 34 (1920), No. 136, pp. 471–492, figs. 3*).—This is a study involving the application of the age and area theory to the floras of the islands outlying between New Zealand and the nearest larger areas of land to the north or northwest. It is claimed to be equally applicable to them, and to show that these islands probably once formed part of a land mass or masses running down to New Zealand from Indo-Malaya. Lists are given of the New Zealand genera showing supposed plant invasions; of the genera of the islands, showing those that reach New Zealand; and of the endemics of the islands. It is claimed that the plant invasions of New Zealand were probably four in number, northern, Kermadec, western, and southern.

The relative efficiency of cross and of self fertilization in some plants, Y. EMOTO (*Jour. Col. Sci. Imp. Univ. Tokyo, 43 (1920), Art. 4, pp. 31, pls. 2, figs. 6*).—Detailed studies are noted as bearing on the efficiency of cross and of self fertilization in *Primula sinensis, P. obconica, Brassica campestris chinensis,* and other plants.

[Chromosomes], T. SAKAMURA (*Jour. Col. Sci. Imp. Univ. Tokyo, 39 (1920), Art. 11, pp. 221, pls. 7, figs. 24*).—This is an account of experimental studies on cell division and nuclear division, with particular reference to the forms, sizes, and numbers of chromosomes. An extensive bibliography is appended.

The chromosome number of Zea mays, Y. KUWADA (*Jour. Col. Sci. Imp. Univ. Tokyo, 39 (1919), Art. 10, pp. 148, pls. 2, figs. 3*).—This is a contribution to the hypothesis of chromosome individuality and on the descent of *Z. mays.* A bibliography of more than 100 titles is appended.

New species of Uredineae, XII, J. C. ARTHUR (*Bul. Torrey Bot. Club, 47 (1920), No. 10, pp. 465–480*).—Study of herbarium material subsequent to that previously noted (E. S. R., 43, p. 222) has resulted in the separation of new forms and correction of errors, which are indicated.

FIELD CROPS.

[Report of field crops work in Idaho, 1920] (*Idaho Sta. Bul. 122 (1921), pp. 23, 53, 56, 59, 60, 61*).—Further progress of work previously noted (E. S. R., 41, pp. 225, 226) is reported.

Results of cultural tests with field peas show early seeding, drilled at a medium depth at the rate of 120 lbs. per acre, to give maximum yields. Field peas excelled small grains as a nurse crop for sweet clover. In rate of seeding tests with sweet clover, 15 lbs. of scarified seed gave the maximum yield and quality of hay the second season of growth. Studies of the relation of age of corn to yield of silage indicated the need of early planting for late-maturing varieties, while with acclimated varieties later plantings gave the highest silage yields.

At Aberdeen Substation, where sunflowers were drilled and spaced 18, 12, and 6 in. in the row, 18 in. spacing led in quality and yield, producing 28.5 tons per acre as compared with 24.3 tons from unthinned.

Alfalfa seeded in corn beginning to tassel, the field being then irrigated immediately and kept wet until the seed had germinated, produced good stands at the Caldwell Substation. Variety tests of cereal, forage, and silage crops at the Felt High Altitude Substation and the Sandpoint Substation are also noted.

[Report of field crops work in Louisiana, 1920], W. C. TAGGART, A. F. KIDDER, and G. D. CAIN (*Louisiana Stas. Rpt. 1920, pp. 8, 11, 12, 13, 14*).—The continuation of work noted heretofore (E. S. R., 43, p. 635) is described. Variety trials of sugar cane at the Sugar Station showed the juice of L–511 to contain 14.75 per cent sucrose as compared with 12 per cent for D–74 and 11.75 per cent for Purple. L–511 continued to show marked resistance to the mosaic disease. Fertilizer tests are also briefly noted.

At Baton Rouge, soy beans seeded in corn at the last cultivation in a rotation of cotton and corn gave an increase of about 100 per cent in both cotton and corn. In practically all cases, corn varieties planted at the rate of 6,000 stalks per acre produced more corn than when planted at the rate of 7,000 and 8,000 stalks per acre.

The leading field-crop varieties at the North Louisiana Station included Calhoun Red Cob corn, New Era cowpea, Mammoth Yellow soy bean, and Osceola velvet bean.

[Report of field crops work in Michigan, 1919), J. F. Cox (*Michigan Sta. Rpt. 1919, pp. 286–318, figs. 11*).—The progress of work along the same general lines as noted heretofore (E. S. R., 41, p. 636) is reported. A brief account of plant-breeding work and a detailed discussion of the methods used and results secured in the improvement of the oat crop at the station from 1900 to 1919, by F. A. Spragg, are also included.

[Field crops work at McNeill, Miss., Substation, 1912–1917], E. B. FERRIS (*Mississippi Sta. Bul. 188 (1920), pp. 9–18, 20–22*).—This supplements earlier work (E. S. R., 28, p. 230) for the period 1912 to 1917, inclusive.

Detailed results of work with cotton have been noted already (E. S. R., 29, p. 35; 31, p. 136). The crop is not recommended for culture in the two tiers of Mississippi counties nearest the Gulf on account of excessive rainfall and the boll weevil. Tests of commercial fertilizers with corn and cotton indicated that land in this section could not be cropped economically without the aid of live stock and the resultant manure. Hastings Prolific, Vardaman, and Tennessee Red Cob, with respective acre yields of 34, 37.2, and 33.4 bu., led the corn variety tests in 1912, 1913, and 1914, respectively. Results with sorghums and other forage crops (E. S. R., 39, p. 230), and velvet beans (E. S. R., 38, p. 342), have been noted heretofore. Notes are also given on variety tests with oats and sweet potatoes, and the yields for 1903 to 1913, inclusive, of seed cotton, oat hay, pea hay, and corn in rotation tests are tabulated without conclusions.

Land subsoiled to a depth of 30 in. with dynamite yielded 9,886 lbs. of corn silage and 1,840 lbs. of oat hay per acre, while that not subsoiled made 11,448 lbs. of silage and 1,410 lbs. of hay. These and previous results indicated that the practice of subsoiling the land in question was not worth the expense involved.

[Report of field crops work at South Mississippi Substation, 1918–1920], E. B. FERRIS (*Mississippi Sta. Bul. 194 (1920), pp. 8–23*).—Work with field crops at the South Mississippi Substation at Poplarville is reported for the years indicated, continuing that conducted at McNeill noted above. The experiments included variety and fertilizer tests with cotton, corn, and sweet

potatoes, spacing tests with cotton, and trials of nitrogen carriers. The results of the several tests are tabulated and discussed. The information included on cotton growing in south Mississippi has been noted from Bulletin 196 (E. S. R., 45, p. 129).

[Report of field crops work in Missouri, 1919–20], W. C. ETHERIDGE, C. A. HELM, and L. J. STADLER (*Missouri Sta. Bul. 179 (1921), pp. 30–36*).—Continuing work already noted (E. S. R., 43, p. 735), variety, cultural, and fertilizer tests with various field crops are described.

Biggs Seven-ear led the prolific corn varieties with a 3-year average acre yield of 24.3 bu., while Commercial White was first of the native types, averaging 22.9 bu. In cultural experiments at both Maryville and Warrensburg, the maximum yields were obtained when no normal cultivation was followed, but the surface was scraped clean throughout the growing season. The results indicate low yields from late cultivation and high yields from surface scraping.

In trials of seasonal forage crops at Warrensburg, spring seeded oats and Canada peas, with 3.27 tons per acre, and summer seeded sorghum and soy beans, with 3.38 tons per acre, gave the best results. Sudan grass seeded in 3-ft. rows averaged 2.44 tons of cured hay per acre from a single cutting made October 3, while seeding in 8-in. rows with a grain drill gave but 1.93 tons. When seeded in 3-ft. rows at Columbia in early summer, a total of 4 tons per acre was made in two cuttings up to September 15, and 14.5 bu. of seed up to October 1.

Wheat-breeding investigations comprised studies of hybrid and pure-line selections. Tests of commercial varieties of spring and hard and soft winter wheat showed the superiority of the hard winter Kanred, and the semihard Fulcaster over the soft wheat, Michigan Wonder, and the spring wheats, Scotch Fife and Marquis; the inferiority of Kanred at Warrensburg; and the very marked inferiority of spring wheat at Columbia and Maryville. Mediterranean selection 31 with 32.7 bu., Mediterranean selection 30 with 31.7 bu., and Harvest Queen with 31.6 bu. led in 6-year average yields as compared with 26.1 bu., the average of all varieties, and 24 bu. from the original Mediterranean stock.

Texas Red, with an average acre yield of 35.7 bu., and American Banner, with 35.1 bu., were first of early and late oats varieties, respectively. In nursery tests at Columbia, Irish Victor, Kherson, Sixty-day, and Fulghum led in the order named.

Treatment of soy bean stubble by either harrowing, single or double disking with or without harrowing, or double disking, rolled, failed to show profit over no treatment in preparation of a seed bed for wheat. It is indicated that bean stubble land, spring plowed and kept fairly clean during the season, is without further treatment an excellent seed bed for wheat.

Leading soy bean varieties at Columbia, in seed production, were Tokio with 23.3 bu. and Mikado and Morse with 20.5 bu. Chiquita with 3.3 tons and Columbia with 3 tons of cured hay were first in hay yields. Comparisons of soy beans and cowpeas for hay and seed showed the strong superiority of the soy bean for both purposes. New Era, Red Ripper, and Groit, with 21.8, 21.1, and 20.3 bu. per acre, respectively, were the leading cowpea varieties.

Fertilizer and variety tests with cotton are also noted. Significant differences between average yields of large and small boll varieties were not observed.

Results of cultural experiments with alfalfa and sweet clover at Columbia showed that on average Missouri upland sweet clover invariably outyielded alfalfa, differences in sweet clover being greatest on untreated land and least on land well limed, fertilized, and manured. Sweet clover or alfalfa seeded with a nurse crop gave much lower yields than when seeded alone. Small grain nurse crops seeded with sweet clover gave decidedly lower forage and grain

yields than when alfalfa was sown with them, due doubtless to the heavier growth and greater competition of the sweet clover.

Grain sorghums outyielded corn varieties by a wide margin at Warrensburg and Cuba. The average yield of 4 sorghum varieties was 30.1 bu. per acre, while that of 8 corn varieties was but 23.2 bu. Dwarf Milo, with 38.8 bu. of grain per acre, led the sorghum varieties.

[Report of field crops work in North Dakota, 1919–20] (*North Dakota Sta. Bul. 146 (1921), pp. 10–13, 14–20, 35, 36, 37, 38, 41, fig. 1*).—Experiments with field crops including variety and cultural tests of wheat, oats, barley, rye, flax, and potatoes; milling and baking tests with wheat; rotations; seeding trials of sweet clover; and breeding work with alfalfa, smooth brome grass, wheat, and corn, and disease-resistant varieties of wheat, rye, and flax are described in continuation of work already noted (E. S. R., 43, p. 332). Cross-fertilization studies with alfalfa have been noted (E. S. R., 45, p. 36).

The leading varieties as indicated by tests include Marquis, Dakota Bluestem, Kota, and Monad wheat; Kherson and Swedish Crown oats; Manchuria barley; Wisconsin 1219 rye; North Dakota flax selections; and King potatoes.

[Report of field crops work at the Edgeley Substation, 1914–20], O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 9–19, 26–37*).—Variety, cultural, fertilizer, and rotation tests conducted in cooperation with the U. S. Department of Agriculture are reported in continuation of work previously noted (E. S. R., 32, p. 528).

In variety tests with spring wheat during the period 1908–1916, the highest average acre yields produced in each class were for fife 19.5 bu., bluestem 14.4 bu., Preston 15.8 bu., and durum 20.5 bu. The durums outyielded the bluestem varieties 6.2 bu. and the fife 4.7 bu. per acre. Flax varieties averaged from 11.2 to 12.9 bu. per acre during the five-year period 1912–1916. Early, medium, and late ripening varieties of oats made 10-year average yields of 43.3, 48.1 and 41.7 bu. per acre, respectively. Northwestern, Rustler white, and Golden were among the best of the dent corn varieties tried, and Gehu, Dakota white, and Squaw are considered probably the best flint varieties for the region.

Results of trials indicate that the profitable culture of feterita, kaoliang, Sudan grass, and Early Amber cane is doubtful under the climatic conditions. German and Siberian millets yielded more and better hay than hog millet, but the latter led in seed production. Ten-year average yields of forage crops, including brome, alfalfa, red clover, and corn were 2,724, 2,078, 1,160, and 3,960 lbs. per acre. Cultural directions for brome grass, Canada field peas, sweet clover, slender wheat grass, and alfalfa are indicated in brief.

Variety trials with potatoes show Early Ohio and Early Six Weeks best adapted.

Rate of seeding trials indicate that where a continuous cropping method is followed, the highest yields in durum hard wheat and oats are secured from an intermediate to a heavy rate of seeding, and that barley averages best from a light rate of seeding, about 1.5 bu. per acre. Where very thin seeding was practiced, the field was very weedy and occasionally the weeds interfered with harvesting.

In cooperative work in cultivation methods with the U. S. Department of Agriculture during a 14-year period, 1907–1920, summer tillage gave an increased yield over continuous cropping of 1.6 bu. per acre for wheat, 13.6 bu. for oats, and 2.8 bu. for barley, and a decrease of 279 lbs. for corn. Summer tilling land in rotation gave an increase of 2.4 bu. per acre of wheat and 5.9 bu. of oats in comparison with the yields of the same crops after small grain. A comparison of 13 years' average yields of wheat and oats secured after green manure crops and after fallow in the same type of rotation failed to show striking differences,

except that where oats followed green manure from 2 to 5.9 bu. less were produced. Wheat immediately following a manured fallow gave 1.8 bu. and oats 1.3 bu. more per acre than where the fallow was not manured. Corn grown the second year after manure was applied generally gave better yields than where the land was unmanured, averaging from 877 to 967 lbs. per acre in favor of the manured rotation. The results indicate that the addition of manure to land intended for corn rather than to the fallow would minimize the tendency of manure to cause a heavy growth of straw in the cereals. An increase of 0.7 bu. of wheat and 4.6 bu. of barley per acre in favor of corn land as compared to summer fallow, and a gain of 4.9 bu. of oats per acre in favor of summer fallow were noted. Although the difference between the two methods is low, the heavy yields of coarse food provided for live stock feeding by corn land would more than offset gains occurring from summer fallowing.

Oats following alfalfa, brome, clover, and wheat and barley made 13-year average acre yields of 25.9, 27.6, 30.3, and 31.8 bu., respectively. Observations made to note the effect of one crop on those which follow show that this effect is mostly due to moisture being reduced by the preceding crop. Wheat, oats, and barley after corn showed gains in yield over the same crops grown continuously or after other small grains in rotation. Wheat after corn, oats, and wheat produced 14-year average acre yields of 17.1, 14.1, and 11.6 bu., respectively; oats following corn, barley, wheat, and oats averaged 34.4, 30.3, 31.9, and 26 bu., respectively; and barley after corn, oats, and barley made respective average acre yields of 24.5, 22.4, and 17 bu.

About equal returns for wheat and oats were given from fall and spring plowing, but higher yields of barley and corn resulted from spring plowing. Fall plowing has a decided advantage over spring plowing for cereal crops, permitting earlier seeding. Disking corn ground produced a gain of 0.7 bu. per acre for wheat and 1.4 bu. for oats over plowing the land.

The use of commercial fertilizers in continuous cropping with wheat, oats, barley, and corn did not produce outstanding results, and it is considered questionable whether the additional profits secured from their use will pay for the cost of fertilizer and application.

[Report of field crops work in Wisconsin, 1919–20] (*Wisconsin Sta. Bul. 323 (1920), pp. 17, 29, 58, 59, 73, 75–92, figs. 14*).—The progress of work conducted in continuation of that noted heretofore (E. S. R., 44, p. 225) is outlined.

Investigations by W. E. Tottingham and S. Lepkovsky regarding changes of nitrogen compounds in the leaves of the sugar beets during the day and night indicate that the greatest manufacture of protein in the leaves closely follows the largest production of carbohydrates. With the coming of moderately cool nights (50° F.) the increase of soluble protein in the leaves was particularly striking.

Analyses of soy bean selections from the seventh year's work in breeding for increased oil content showed a high line strain and a low line strain, with iodin indices of 132 and 124, respectively, indicating the effect of selection. The low line strain was entirely of a dwarf type, while the high line strain consistently produced both tall and dwarf types, pointing to a definite relation between plant height and quality of oil. A high-producing strain as well as a low-producing strain has been isolated.

In trials made by J. G. Milward, in cooperation with the U. S. Department of Agriculture, to determine some of the factors influencing freedom from disease, vigor, and productiveness in five leading varieties of potatoes, differences varying from 5 to 90 per cent of infection with mosaic disease were found in the 1 strains of Triumph studied. The Smith strain showed the least infection, count

ranging from 2 to 10 per cent, and also proved uniformly superior in all comparative trials, in both the North and South.

Australian field cress is described as a new exceedingly noxious weed pest, worse than either quack grass or Canada thistle, and closely resembling yellow marsh cress (*Radicula palustris*) in leaf characters. Cultivation spreads the pest further. Although covering small patches in alfalfa plats with straw to 3 ft. in depth proved useless, a 6 ft. depth of straw held the weed in check. Covering isolated areas with a heavier grade of building tar paper was the more effective treatment.

Work with alfalfa was conducted at Madison by L. F. Graber. Records for the period 1915–1920 show a total yield of Grimm variety from 20.8 to 22.5 tons per acre, while Montana common ranged from 13.1 to 18.7 tons per acre. In a 2-cutting crop, plats 1 and 3 years old made 4.2 and 5.7 tons, respectively. At the time of blossoming the older alfalfa in both cuttings was fully 9 in. taller, and the root system was much larger, deeper, and more widely developed. Results secured by E. J. Delwiche at the Spooner Substation show that the crop can be grown successfully on sandy loam soils, with yields in normal seasons equaling clover. One hundred strains planted in 1916 from seed of resistant plants have not shown indications of winter-killing. Studies of different varieties from various sources have evolved a method of distinguishing genuine Grimm, Baltic, and Cossack varieties from nongenuine varieties during the first season the alfalfa is grown. The genuine hardy varieties undergo a period of fall dormancy which sets in at a comparatively early date, while the common varieties continue to grow in the fall of the year, especially when there is a reasonable amount of rainfall. In controlling weed growth, close cutting gave better results, without seriously injuring the alfalfa, than where as much as 5 in. of alfalfa was left. Where close cutting was practiced, virtually all weed growth was held in check, and with a normal amount of moisture a new, healthy, vigorous alfalfa growth developed. In plats where the alfalfa was clipped long, foxtail grew rapidly and headed out, requiring the cutting of the field again in August to save the alfalfa.

Experiments by G. B. Mortimer indicated that about 20 lbs. of Sudan grass seed per acre gives the best returns, with an average of 3.2 tons of hay. Results of five years' experiments show an average hay yield of 2.5 to 3 tons per acre, which is in excess of the yields of either common or German millet grown under similar conditions. Sudan grass did well with all varieties of soy beans used when drilled at the rate of 10 lbs. with 60 lbs. of soy beans. Yields of cured hay obtained with Wisconsin varieties of soy beans ranged from 2.8 to 3.3 tons per acre. Better results were secured from Sudan grass alone and also Sudan grass with soy beans than from peas and oats for hay. Where peas were used with medium late oats, 2.72 tons of cured hay was produced, as compared with 2.13 tons with an early oats variety.

Variety tests with winter and spring wheat and rye, oats, and barley were conducted by B. D. Leith. The 1920 yield of Wisconsin Pedigree No. 2 winter wheat (Turkey Red) was 46.7 bu., as compared with a 5-year average acre yield of 33.9 bu. During the latter period the yield of spring wheat was about one-half that of winter wheat. In a 3-year test with rye, Wisconsin Pedigree No. 2 averaged 44.5 bu. per acre, while Rosen made 34.9 bu. During this period the yield of spring rye averaged only about half that of winter rye.

In tests of soy-bean varieties conducted by G. M. Briggs, Elton and Early Green proved suitable to Wisconsin conditions, and of the early seed varieties, Mongol was preferable to Mammoth. Planting soy beans in corn failed to effect an increase in yield over planting corn alone, due, perhaps, to interference with cultivation, which permits weed growth.

In trials of sunflowers for silage, E. D. Holden found that the Argentine variety made 8.33 tons of silage per acre, while Giant Russian made from 20 to 25.75 tons. Sunflowers proved more drought resistant than corn, producing larger and heavier crops. Where corn was killed by frost in early September, sunflowers were one-third taller than the corn, of normal green color, and showed no effects of frost. When 10 to 30 per cent of the plants are in bloom is deemed the most favorable time for cutting.

In further comparisons by Leith, when No. 12 Golden Glow corn and the cold-resistant strain were planted on May 1 at the station, but 69.8 per cent of Common No. 12 had emerged on May 19, as compared with the cold resistant as 100 per cent. Where maturity counts were made on August 31, 68 per cent as much common Golden Glow had matured as the cold resistant. H. W. Albertz found that corn gathered two weeks before the regular harvesting time when the kernels were just beginning to dent and containing about 50 per cent moisture, germinated equally as well as or better than that gathered at the regular harvest, if properly cured with artificial heat.

In work with field peas by Delwiche, culture inoculated peas yielded 1,333 lbs., soil inoculated 1,125 lbs., and uninoculated 1,016 lbs. of seed per acre. Tests at the Spooner Substation indicate the possibility of growing peas on the lighter types of soils which are free from excess moisture, thereby lessening the danger from blight and rot.

Work with hemp and fiber flax was conducted by A. H. Wright, of the U. S. Department of Agriculture. During 1920, 6,500 acres of hemp, an increase of 2,000 acres over 1919, were grown in the State. Hemp grown on marsh land made very good growth, the quality of fiber depending on the length of the cultivation of the land and the succession of crops. Fiber obtained from newly broken marsh soils was practically worthless for spinning, but where hemp was grown 2 or 3 years in succession on marsh lands, decided improvement followed. When the crop was grown on soil cultivated with intertilled crops for 5 to 10 years, a very good quality of fiber was produced. The hybrid Ferramington (Minnesota No. 8 × Ferara) matures early enough to produce good seed yields and attains a better height than Italian or other early-maturing sorts, and is being further selected. Although many Japanese strains are good, the possibility of securing from Japan the kind of seed ordered should be determined, as many strains supplied by Japanese dealers are of the so-called bird seed types and valueless for fiber.

Dodgeville and Mazo Amber possessing total solids ranging from 17 to 22 per cent, gave good results in sorghum work.

The improvement of our crops by selection, E. E. Barker (*Porto Rico Dept. Agr. and Labor Sta. Circ. 30 (1920), Spanish ed., pp. 3–24, figs. 2*).—A popular discussion of methods of improvement by selection with sugar cane, yams, yautias, malangas, sweet potatoes, corn, rice, cotton, tobacco, vegetables, fruits, pineapples, coffee, coconuts, and bananas. Forms are included for judging and securing field notes on the various crops considered.

Variety tests of corn, wheat, and soy beans, J. E. Metzger and G. Eppley (*Maryland Sta. Bul. 237 (1920), pp. 23, figs. 10*).—The experiments reported supplement earlier trials of varieties of corn (E. S. R., 33, p. 528), wheat (E. S. R., 37, p. 340), and soy beans (E. S. R., 37, p. 442). See also another note (E. S. R., 43, p. 133).

The leading corn varieties in the period 1915 to 1919, inclusive, included Boone County White, Thomas, Giant Beauty, Golden Gem, and Silver King. Among the first in the 10-year average yields of wheat varieties were Mammoth Red, China, Currell Prolific, Turkish Amber, and Bearded Purple Straw. Of new varieties grown but 3 years, Kharkov and Leap Prolific made good yields, while

Kanred proved very unsatisfactory. Results of tests extending over a long period indicate that Virginia, Wilson, Edna, Cloud, and Haberlandt are the best varieties of soy beans for Maryland. Virginia was highest in seed production throughout the test. Patuxent is considered a valuable soy bean for the Piedmont region.

[Work with rice and cotton in Texas] (*Texas Sta. Rpt. 1919, pp. 10, 11, 14*).—Outstanding results in studies of the effect of environment on the development of the rice plant have shown that surface irrigation water is essential to its maximum development. When applied almost continually throughout the season, the chief effect of surface water is to increase tillering, thus providing for more heads, while influencing only slightly the difference in the size of the heads and kernels.

Inheritance studies with cotton involving widely contrasted characters, such as green and red plant color, white and colored lint, long and short fiber, and upright and spreading plants, are noted. In studies of the inheritance of high and low oil content in cotton seed, plants of the high oil strain of F_0, F_1, F_2, and F_3 generations averaged 19.51, 20.72, 19.97, and 17.32 per cent of oil, respectively, while the seeds from the plants of the low oil strain averaged 16.89, 18.2, 17.88, and 15.54 per cent in the same respective generations.

Profitable root crops, E. J. DELWICHE (*Wisconsin Sta. Bul. 330 (1921), pp. 22, figs. 12*).—A popular account of the production and utilization of root crops in Wisconsin. Cultural and field operations employed in growing and harvesting rutabagas, turnips, sugar beets, and mangels, and storage practices are outlined in brief.

Experiences with alfalfa, S. C. DAMON (*Rhode Island Sta. Bul. 184 (1921), pp. 26, figs. 4*).—Results of experiments and experiences in growing alfalfa at this station during a period of over 25 years are summarized and information on the culture and harvesting of the crop presented. See also an earlier note (E. S. R., 28, p. 737).

Alfalfa grown for 10 consecutive seasons on one plat averaged over 2.5 tons of hay per acre. Drilling seed proved better than broadcasting. Seeded with oats as a nurse crop, alfalfa made but little growth. Alfalfa seeded early in July yielded practically as much as that sown early in April. Seeding 15 lbs. of alfalfa and 7.5 lbs. of timothy per acre gave an average of 3.8 tons of superior quality hay, of which the first cutting was a good mixture and the second and third almost clear alfalfa. Although the 5-year average acre yield of a mixed seeding of alfalfa and orchard grass was 3.91 tons as compared with 4.5 tons of alfalfa, the mixture dried faster than clear alfalfa and produced a good quality of hay relished by stock. Drilled at the rate of 5 lbs. per acre on a relatively light piece of sloping witch grass sod after a liberal application of lime and floats had been harrowed in, alfalfa gave an average acre yield of 4.4 tons of hay, but the second year about 50 per cent of witch grass was found, and in the third year a still greater percentage. Alfalfa seeded in corn in an attempt to improve a light unproductive soil did not meet with much success (E. S. R., 44, p. 626), nor did that broadcasted on frozen ground make a successful growth.

Results of liming experiments (E. S. R., 32, p. 622; 42, p. 625) show conclusively the value of an adequate application of lime previous to seeding alfalfa. Mixing the lime with the subsoil at the bottom of the furrow before seeding did not increase the alfalfa yield (E. S. R., 35, p. 229). The use of either slacked lime or sodium carbonate as a top-dressing for alfalfa did not increase yields, even though no lime had been added for a number of years previously and the soil was quite acid.

From results on limited areas the use of nitrate of soda in fertilizer for alfalfa was not considered advantageous. So-called American rock potash com-

pared favorably with sulphate of potash when used in a fertilizer for alfalfa (E. S. R., 42, p. 430).

Allowing the first and second crops of alfalfa to obtain their full growth before making the cutting was of decided advantage. The success of alfalfa as a cover crop is held to be dependent on the freedom from alternate freezing and thawing which tend to cause heaving. About 90 per cent of alfalfa roots from the North Dakota Station, planted in 1912, were still alive in 1920. Plants with bluish flowers made more vigorous growth and gave larger yields than those with yellow blossoms. Field transplanting of plants was found to have some advantage.

The regional adaptation of corn in Nebraska, T. A. KIESSELBACH and F. D. KEIM (*Nebraska Sta. Research Bul. 19 (1921), pp. 64, figs. 13*).—Investigations to determine some of the factors involved in the regional adaptation of corn, by making a comparative study of native corn types known to be locally adapted to various regional areas in Nebraska through long growth, are described. Meteorological and soil data show the widely diversified growing conditions in different regions of the State. Morphological and histological plant characteristics involved in the adaptation of dent corn to various Nebraska environments, together with comparative yield data, are assembled and tabulated by localities into eastern, central, and western Nebraska groups. The material studied comprised native corn types representing 12 different parts of the State, grown in and out of their home environment.

From the relatively favorable conditions of eastern Nebraska to the combined short season, low temperature, and low precipitation of western Nebraska the native corn types assume more and more a dwarfish growth habit. The stalks become shorter and bear the ear closer to the ground. The total leaf area per plant decreases through a reduction in number, length, and width of leaves. The ratio of leaf area to dry plant substance and the proportion of grain to stover remain fairly constant. The ears become shorter, smaller in circumference, fewer rowed, and frequently are scrubby in appearance; and the shelling percentage lowers, and the kernels become shorter and more flinty, as well as slightly lighter in weight. The average measurements of plant characteristics of native corn types grown in eastern Nebraska are given, and, based on these measurements as 100 per cent, the relative values for central and western Nebraska, respectively, are as follows: Height of stalk 8.05 ft., 78 and 68 per cent; height of ear 3.5 ft., 66 and 40 per cent; leaf area 1,222.1 sq. in., 67 and 44 per cent; stover weight 198.6 gm., 74 and 50 per cent; ear weight 231.2 gm., 67 and 39 per cent; total dry matter 429.8 gm., 70 and 44 per cent; grain weight 194.1 gm., 63 and 35 per cent; shelling percentage 83.5, 95, and 89 per cent; leaf area per gram of dry matter 2.89 sq. in., 95 and 98 per cent; ear length 7.36 in., 90 and 79 per cent; ear circumference 6.17 in., 94 and 84 per cent; kernel length 0.485 in., 93 and 84 per cent; kernel width 0.316 in., 103 and 101 per cent; and kernel weight 0.2854 gm., 85 and 61 per cent.

Extensive studies of leaf structure show the leaf and epidermal thicknesses of native types to be fairly constant throughout the State. In the less favored regions, the stomata tend to be somewhat smaller and greater in number per unit leaf area. This stomatal character is associated with a rather corresponding reduction in size of epidermal cell, which the author ascribes to a more dwarfish development. The number of vascular bundles per unit cross section of leaf is fairly constant. While some of the vegetative characters, such as total leaf area and plant weight, may be reduced as much as 300 per cent, no important histological leaf characters exhibit more than 15 per cent deviation in native types growing in the most adverse as compared with the most favored

parts of the State. Practically speaking, adaptation with corn consists in a morphological rather than a histological reaction.

The immediate effect of moving corn from its native environment to less favorable conditions, climate being the chief variable factor, was generally a reduction in both vegetative growth and grain production, the stunting growth effect extending to the cell unit, which in turn was accompanied by histological changes apparently not of an adaptive nature. On the contrary, moving corn to conditions more favorable than its native habitat accelerated the vegetative growth and grain production. This stimulating growth effect extended to the cell unit with its accompanying histological changes, likewise not thought to be of an adaptive nature.

To determine the actual hereditary difference between types adapted to favorable and unfavorable climatic conditions, eastern and western Nebraska corn were compared at the station in Lancaster County. The western corn was much smaller in plant size, leaf area, and dry matter. Plants from seed of both sources were rather similar as to leaf thickness, epidermal, and cuticular thickness, relative numbers of vascular bundles, number of stomata per unit leaf area, and size of stomata. While slightly shorter stomatal aperture, accompanied by a slightly smaller epidermal cell, appears to be characteristic of the short season dry land types of western Nebraska, this shortening of stomatal aperture is not effective in checking the transpiration rate per unit leaf area. When Kimball County (western Nebraska) corn and Lancaster County (eastern Nebraska) corn were compared by the potometer method as to their relative transpiration rates, Lancaster County plants were 51 per cent taller, had 88 per cent greater leaf area, and 79 per cent greater dry matter than Kimball County corn, and used 81 per cent more water per plant, 3 per cent less water per unit leaf area, and equal amounts of water per unit dry plant substance produced. In a comparison of two varieties each from western and eastern Nebraska and from New York State the seasonal transpiration per unit leaf area was respectively, 102, 101, and 100 gm., with the corresponding total plant transpiration 85.8, 114.7, and 97.2 kg., respectively. The data are held to indicate that adaptation of corn to a region of moisture shortage consists in the reduction of vegetative development and consequent reduction in the amount of water used by the individual plant.

In a comparative 2-year-yield test at the station of corn types representing 12 distinct regional areas within the State, those from the nearest localities yielded highest. When grouped into eastern, central, and western Nebraska groups, the acre yields were, respectively, 59.8, 46.2, and 31.6 bu., for equal planting rates normal for adapted types in Lancaster County, with corresponding maturity dates—September 24, 21, and 12. When native station Hogue Yellow Dent was compared at the station with varieties from local farmers and from distant eastern Nebraska farmers, the relative grain yields of the three groups were, respectively, 100, 94, and 91. Corn from southeastern counties averaged 56.9 bu. as compared with 63.7 bu. for seed from northeastern counties, and 66.7 bu. for the station Hogue Yellow Dent, with relative group yields of 85, 96, and 100, respectively.

Local station seed yielded 18 per cent more than imported seed from the experiment stations of 8 neighboring States acclimated to conditions prevailing at those stations. From these tests native seed is held generally superior to imported seed. While it is entirely possible to secure seed from other sources which may be substituted for the native home grown seed without detriment, importation from a distance is considered hazardous.

Lines of greatest type similarity run diagonally across the State in a northeasterly and southwesterly direction. Along these lines the more favorable

temperature and longer growing season of the southern portion tend to counterbalance the more favorable precipitation of the northern portion in their effects upon the hereditary growth habits of corn. When seed corn is moved far within the State, it is usually safest to move along such lines.

The claim that corn native to dry-land regions possesses a special efficiency in grain production, producing, in contrast to corn native to more humid regions, a relatively large amount of grain in proportion to its vegetative growth was not substantiated by the data obtained.

Fertilizing the corn crop, C. E. THORNE (*Ohio Sta. Mo. Bul. 6 (1921), No. 3–4, pp. 35–37*).—The effects of limestone, acid phosphate, and other fertilizers and manure on yields of corn are described. In 5-year rotation experiments with corn, oats, wheat, clover, and timothy, corn grown on land limed for each corn crop at the rate of 2 tons per acre since 1901, and on land unlimed, produced respective acre yields of 36.4 and 21 bu. in 1920 as compared with 27-year averages of 31.1 and 24.7 bu., respectively.

Treatment with acid phosphate at the rate of 80 lbs. per acre each on corn and oats and 160 lbs. on wheat has increased the average yield of corn for five successive 5-year periods by 3.96, 9.74, 9.78, 7.59, and 6.12 bu. in the average of both limed and unlimed land. In 1920 the increase was but 4.42 bu., apparently indicating the need of something besides acid phosphate alone. Where this dressing of acid phosphate was reinforced with muriate of potash, 80 lbs. each on corn and oats and 100 lbs. on wheat, the 5-year average yields were increased by 7.21, 14.17, 19.42, 17.41, and 19.3 bu. for the 5-year periods, and by 16.95 bu. for 1920.

The addition of 160 lbs. of nitrate of soda per acre for each of the grain crops resulted in 5-year average increases of 10.72, 19.45, 24.04, 20.9, and 21.72 bu., and 18.02 bu. for 1920. So far as the corn crop is concerned the increases have not justified the cost of the nitrate.

Where fresh stable manure reinforced with 40 lbs. of acid phosphate per ton was spread upon the land in winter at the rate of 8 tons per acre and plowed under for corn in a 3-year rotation of corn, wheat, and clover, the average annual corn yield for successive periods of 6 years, or two rotations, has been increased by 25.76, 41.19, 39.1, and 35.87 bu. per acre. The total value of the increase averaged $50.12 for each 3-year rotation, or $16.71 per year, as compared with $10.39 per annum for the most effective chemical fertilizer.

In the average of 14 experiments on different county experiment farms, 160 lbs. of acid phosphate has increased the yield of corn by about 5.5 bu. With the addition of 45 lbs. of muriate of potash to the phosphate the increase has risen to 8.66 bu., and with the further addition of 96 lbs. of nitrate of soda to 9.5 bu. While the addition of potassium would be profitable at normal prices for that element and for corn, there is no encouragement for the use of fertilizer nitrogen for corn on clover sod.

Cotton variety experiments [at] Substation No. 3, Angleton, Tex., E. B. REYNOLDS (*Texas Sta. Bul. 274 (1921), pp. 5–10*).—Results of trials with cotton varieties conducted at this substation from 1917 to 1920, inclusive, are reported. The leading varieties were Mebane, Kasch, Lone Star, Acala, and Snowflake, with average acre yields of 485, 462, 458, 409, and 304 lbs. of lint, respectively, and 860, 705, 787, 746, and 654 lbs. of seed.

Sea Island cotton in St. Croix, L. SMITH (*Virgin Islands Sta. Bul. 1 (1921), pp. 14, pls. 2*).—A résumé of work conducted with Sea Island cotton in St. Croix. The progress of many of the early experiments in improvement by hybridization and seed selection has been noted from other sources (E. S. R., 33, p. 834; 44, p. 332). Cultural and field practices obtaining on the island are outlined, and diseases (E. S. R., 32, p. 642) and insect pests are described and

control methods indicated. Plat tests of individual cotton-plant selections, conducted in 1919–20, have been noted from another source (E. S. R., 45, p. 126).

Linters, A. M. AGELASTO (*U. S. Dept. Agr., Dept. Circ. 175 (1921), pp. 10*).—This circular describes the character and length of fiber and the production of linters and discusses the marketing and uses of the material. The manufacture of mattresses and explosives from linters is briefly noted in outline. The need of standards and further utilization to facilitate trade and prevent waste of the commodity is indicated.

Spur feterita, A. B. CONNER and R. E. DICKSON (*Texas Sta. Bul. 275 (1921), pp. 7–28, figs. 14*).—The origin, adaptation, and description of feterita and Spur feterita are presented, together with data on the monthly distribution of precipitation at Spur, Lubbock, and Temple, Tex. Spur feterita originated at the Spur Substation "as a result of selection and head-row planting." The average results of comparative tests with the improved feterita and other sorghums may be summarized as follows:

Data on sorghum growth and yields at Spur (Texas) Substation in 1919.

Crop.	Stalk.		Length of growing season.	Grain per head.	Acre yield.
	Diameter.	Height.			
	Cm.	*Cm.*	*Days.*	*Per cent.*	*Bu.*
Spur feterita	1.88	156	97	76.7	50.1
Unimproved feterita	1.47	188	90	72.6	45.6
Milo	1.60	108	94	76.4	33.1
Kafir	1.85	111	115	74.3	29.2

Fertilizing the oats crop, C. E. THORNE (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 38, 39*).—Experiments on the effect on the oats crop of liming, acid phosphate, residual effect of manure, and fertilizers carrying phosphorus and potassium only are described.

In a five-year rotation experiment, including corn, oats, wheat, clover, and timothy, oats grown on land limed for each corn crop since 1905 at the rate of 2 tons per acre of finely ground raw limestone, and on unlimed land, produced 49.2 and 27.4 bu. in 1920, as compared with an average of 35.7 and 29.5 for the period since liming began. On part of the land which received acid phosphate at the rate of 80 lbs. per acre each on corn and oats and 160 lbs. on wheat, or a total of 320 lbs. for each five-year period, the yield of oats in 1920 was 53.75 bu. on the limed half and 42.5 bu. on the unlimed half, indicating that the phosphate had partly made up for the lack of lime. Where the acid phosphate was reinforced with muriate of potash at the rate of 80 lbs. each on corn and oats and 100 lbs. on wheat, the 1920 yields were 63.44 bu. on the limed half and 44.22 on the unlimed half. Where 160 lbs. of nitrate of soda on each of the three grain crops was added to the above dressing the yield was 63.28 and 57.5 bu. on the limed and unlimed sections, respectively. Liming apparently made the use of nitrogenous fertilizers unnecessary by encouraging a larger growth of clover.

On land receiving barnyard manure on corn and wheat at the rate of 8 tons per acre on each crop, the oats receiving no treatment, the yield of oats was 56.56 bu. on the limed land and 54.06 on the unlimed land.

Oats variety test at Ohio State University, J. B. PARK (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 63, 64*).—The leading oat varieties at the University Farm at Columbus were Fulghum, Big Four, Ohio 6203, and Sixty-Day, with three-year average acre yields of 67.6, 65, 63.4, and 61.8 bu., respectively.

Investigations with seed potatoes [in Missouri], J. T. ROSA, JR. (*Missouri Sta. Bul. 179 (1921), p. 40*).—Findings in seed-storage tests indicated that potatoes intended for spring planting can be kept over winter satisfactorily in cold storage at 32 to 40° F., and in cool outdoor cellars.

Potato production in the South, W. STUART (*U. S. Dept. Agr., Farmers' Bul. 1205 (1921), pp. 39, figs. 22*).—In this publication, potato production is considered under three seasonal divisions: The early or truck crop; the late or main crop; and the fall crops, comprising the fall crop proper (late maturing varieties grown for table use), and the second crop (early varieties planted for the purpose of growing seed stock for the early crop of the coming year). The crop areas, soils, fertilizers, cultural and field practices, seed, prevention of diseases and insect pests, marketing, and storage are discussed separately for the three seasonal crop divisions.

The leading varieties used for early-crop production include Irish Cobbler, Triumph, and Spaulding No. 4; for the late or main crop, Green Mountain, Gold Coin, Rural New Yorker No. 2, Carman No. 3, Sir Walter Raleigh, White Star, and Early Ohio; and for a fall crop, usually for table use, McCormick, White McCormick, Jersey Red, Green Mountain, Rural New Yorker No. 2, Russet Rural, White Star, and Peerless.

Rooting stems in timothy, R. A. OAKLEY and M. W. EVANS (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 173–178, pls. 2*).—In investigations at the timothy breeding station, conducted cooperatively at Elyria, Ohio, by the U. S. Department of Agriculture and the Ohio Experiment Station, the authors found two quite distinct types of underground rooting stems in timothy. One type develops when the shoot producing the new plant is covered with soil early in its growth. Some of the unelongated internodes connecting the shoot with the parent plant lengthen, thereby pushing the shoot to the surface of the soil, and roots grow from the nodes between the elongated internodes. A second type of underground rooting stem is produced when timothy plants with growing culms are covered with soil. Buds that sometimes form on the culms of these plants often develop into shoots and ultimately into independent plants, and the culms become underground rooting stems.

Many of the scattering timothy plants appearing in a field where a timothy sod has been plowed under are produced vegetatively from buried stubbles or culms. Rooting stems developing above ground in timothy are not common in this country. Regarding them as a varietal characteristic is considered a very doubtful practice, as apparently they are formed most commonly when weak or decumbent stems come in contact with the soil.

The terms, determinate and indeterminate rhizomes and stolons, are suggested to indicate the types of rooting stems found, especially in grasses.

Yam culture in Porto Rico, C. F. KINMAN (*Porto Rico Sta. Bul. 27 (1921), pp. 22, pls. 6*).—Field practices and cultural methods employed in growing the yam (*Dioscorea* spp.) in Porto Rico are described, and the results of fertilizer, cultural, and vine-pruning tests reported. Descriptions of the Guinea, Potato, Tongo, Purple Ceylon, *D. sativa*, *D. chondrocarpa*, *D. cayennensis*, Agua, and Mapucy Morado varieties and cultural treatment applicable to each are included.

Results of fertilizer tests indicated that no one element can be considered the limiting factor in production, and that complete mixtures should be used where fertilizers are applied. The application of 10 tons of stable manure per acre produced an increase of nearly 10 per cent over untreated or chemically fertilized plats, while the plat receiving 20 tons of manure returned less than the untreated check.

Yields from the plants pruned were considerably less than from those unpruned, indicating that for best results the vines should not be pruned or injured. Vines not provided with supports made very poor growth and low yields of roots.

In size-of-seed, cultural, and spacing tests with the Potato variety, large seed roots gave heavier yields than small roots; the average weight per hill of the produce from small seed was but 65 per cent of that from large seed; and roots produced from large seed roots were considerably larger than those from small seed roots. The yield per hill from small tubers planted in ridges was noticeably heavier than from level plantings. Large roots yielded about the same per hill whether ridged or level. Results of spacing tests suggest 3 by 3 ft. as the most economical planting distance.

Yam culture [in the Philippines], F. G. GALANG (*Philippine Bur. Agr. Circ. 115 (1920), pp. 9, pls. 3; also in Philippine Agr. Rev., 13 (1920), No. 1, pp. 63–72, pls. 3*).—Information is given on the culture of yams in the Philippine Islands, together with results of variety tests, cost of production studies, and comparisons of poling methods.

Seed testing [in Idaho] (*Idaho Sta. Bul. 122 (1921), pp. 47–51*).—A total of 2,769 samples of field seeds were tested for purity and 278 for germination during the period December 1, 1918, to December 1, 1920. Seed sold at auction sales is said to have frequently contained seeds of many of the most noxious weeds.

HORTICULTURE.

[Report on horticultural activities for 1920] (*Idaho Sta. Bul. 122 (1921), pp. 39, 40, 41*).—In a study of truck-crop seed production, satisfactory yields were obtained, as shown by a tabulated comparison of station and United States average yields.

Pollination studies with the sweet cherry indicate that the Bing, Lambert, and Royal Ann varieties are not only self-sterile but also intersterile. Black Tartarian was found to be one of the best pollinizers.

Some conclusions from an unpublished report on apple breeding are included.

Report of the [division of horticulture], H. J. EUSTACE (*Michigan Sta. Rpt. 1919, pp. 278–282*).—Apple-dusting experiments at Morrice, Belding, Muir, and Grand Ledge (E. S. R., 39, p. 349) were continued in an effort to ascertain the value of dusts as compared with sprays. At Morrice dusting gave slightly better scab control on apples than spraying. At Muir dusting has been uniformly successful during the past three seasons, but some foliage injury resulted from the combination of lime sulphur and lead arsenate and severe injury from a combination of lime sulphur and calcium arsenate. At Belding the sprayed trees yielded 6 per cent more scabby fruits than dusted trees. At Grand Ledge calcium arsenate in combination with lime sulphur proved equally as efficient as lead arsenate and lime sulphur for control of the codling moth worm and other insects, but in most of the tests the calcium arsenate caused more or less foliage injury.

[Report on] horticulture (*North Dakota Sta. Bul. 146 (1921), pp. 40, 41*).—Variety testing of fruits and vegetables was the principal feature of the horticultural activities for 1919. Of the vegetables, Blue Bantam pea, Crimson Giant radish, Golden Giant sweet corn, Copenhagen cabbage, and Earliest and Sweetest watermelon gave satisfactory results. Selection work with the Earliana tomato was continued and seed of three selections disseminated for trial.

In hardiness studies with fruits, the Hibernal apple was least injured during the winter of 1919–20. Three red raspberry varieties, the Sunbeam, Ohta, and Latham, survived the winter without protection. Of these, the Latham was by far the heaviest yielder.

[Report of] the division of horticulture, O. M. Morris (*Washington Sta. Bul. 158 (1920), pp. 26, 27, 28–30*).—Brief records are made of the progress of various projects (E. S. R., 43, p. 743).

In Mendelian studies with small fruits, only a few successful crosses were obtained between the loganberry and the dewberry, indicating a condition of practical intersterility. In raspberry-loganberry crosses no viable seed was obtained. Black raspberries crossed readily with the red, producing a satisfactory amount of seed. Blackberry-raspberry crosses were unsuccessful.

Orchard cover-crop investigations indicate that hairy vetch is one of the best legumes to use when first establishing the cover-crop system. After vetch has been grown for two or three years, the orchard may be planted to alfalfa. In renovation studies with old prune trees, it was found that such trees may be often stimulated into production of new and vigorous growth by heavy pruning, after the soil has been improved in condition and fertility.

Improved variety No. 9 of native chili, F. Garcia (*New Mexico Sta. Bul. 124 (1921), pp. 16, figs. 7*).—In selection studies with chili (*Capsicum annuum*), one desirable strain known as No. 9 has been isolated. This strain is described as very vigorous, quite prolific, more resistant to chili wilt than the native chili, and as having less pungent fruits than most of the improved varieties.

Cooperative tomato investigation, J. T. Rosa, jr. (*Missouri Sta. Bul. 179 (1921), pp. 41–43, fig. 1*).—Tomato investigations were continued (E. S. R., 43, p. 742). "In 10 series of cooperative tests in 1919, yields of tomatoes were increased on the average 159.2 per cent by 8 tons of stable manure; 152.9 per cent by 250 lbs. of 4:8:5 fertilizer; 152 per cent by 250 lbs. of 4:8:0 fertilizer; and 106 per cent by 250 lbs. of acid phosphate. The most economical gain for the cannery tomato crop was produced by acid phosphate. Another important result demonstrated in the fertilizer tests was the increased earliness of the crop when commercial fertilizer was used. Plats receiving complete fertilizer came into heavy bearing three to four weeks before the unfertilized plats, and plats receiving acid phosphate were two to three weeks earlier than the unfertilized plats."

The fruit industry in California, R. Videla (*La Industria Fruticola en California. Buenos Aires: Wiebeck, Turtl & Co., 1920, pp. 182+[2], pls. 53, figs. 51*).—A discussion of the California fruit-growing industry in all its phases—production, drying, preserving, shipping, marketing, etc.

[Pomological investigations at the Edgeley Substation], O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 43, 44*).—Hardiness studies with apple, plum, cherry, currant, gooseberry, and strawberry varieties are reported.

[Pomological investigations] (*Wisconsin Sta. Bul. 323 (1920), pp. 56, 59, fig. 1*).—Sterility investigations by R. H. Roberts in Door County showed that Richmond and Montmorency cherries were strongly self-fertile in 1920. Tests indicated that the Burbank plum is self-sterile. Wealthy and McIntosh apples proved to be self-sterile but highly interfertile.

The Salome apple has shown merit as a commercial variety for southern, eastern, and western bluff sections of Wisconsin.

The relation of carbohydrates and nitrogen to the behavior of apple spurs, E. M. Harvey and A. E. Murneek (*Oregon Sta. Bul. 176 (1921), pp. 47, figs. 12*).—This is a report, in the form of two papers, covering two phases of a series of fruit-spur studies being conducted at the station on the relation of nutritional changes in fruit trees to behavior and cultural practices. The

investigations are based upon the theory advanced by Kraus and Kraybill (E. S. R., 40, p. 40) that growth and reproduction depend to a considerable extent on the relative proportions of available carbohydrates and nitrogen. A careful review of the literature is presented.

I. *Effect of spur defoliation on the formation of fruit buds*, E. M. Harvey (pp. 16–31).—This paper discusses the results of a study, the aim of which was to determine to what extent the leaves of the individual apple spur control its metabolism, as reflected in the relations of carbohydrates and nitrogen and the formation of fruit buds. Seven-year-old trees of the Wagener, Grimes, and Jonathan were the source of spurs used in the study.

"A total of about 7,000 spurs were taken for analysis, and these were procured from 10 trees of each variety, and proportioned among the varieties as follows: 1,500 Grimes, 2,500 Wagener, and 3,000 Jonathan. Each tree furnished 150 to 300 spurs, depending upon the variety. One-half of the total number of spurs were de-foliated and de-fruited, and the other half de-fruited as checks. The date of defoliation and defruiting was June 12–16, 1919. To avoid mechanical injury to the spur, the two operations were performed with scissors, the petioles and pedicels being cut at a little distance away from the spur. . . .

"Defoliation strongly hindered fruit-bud formation, as shown by the fact that Jonathan, Grimes, and Wagener spurs were able to produce only 38.7, 54.6, and 58.6 per cent, respectively, as many fruit buds as the untreated spurs. Defoliation tended to make the spurs, especially the Grimes, more vegetative, as evidenced by the frequent putting out of short growth and new leaves. Defoliation modified the chemical composition of spurs so that they contained, as compared with the checks: (1) More water and less soluble solids (?), insoluble solids, and total solids; (2) more nitrate nitrogen, total soluble nitrogen, and insoluble nitrogen; (3) more reducing sugars, total sugars (?), and less of hydrolyzable polysaccharids and total carbohydrates; and (4) smaller values of the carbohydrate-nitrogen ratio. The carbohydrate-nitrogen ratio, if given a general interpretation, might be classified along with other important controlling factors of plant development, but a strict mathematical inerpretation is not justified from the present study.

"The effects of defoliation on spurs suggest a high degree of 'individuality,' or dependence of the spur on its own leaves for normal activity. In respect to the degree of 'individuality' shown, the three varieties assume the following decreasing order: Jonathan, Grimes, and Wagener. A general explanation for this relative behavior is suggested. It is pointed out that the idea of the 'individuality' of spurs might possibly be overemphasized, since defoliated spurs were able to carry on about 50 per cent or more of their normal fruit-bud formation."

II. *Effects of spur defoliation on the setting of fruit*, A. E. Murneek (pp. 32–43).—This paper presents a study, the object of which was to ascertain to what extent unfolding leaves of the individual apple spur influence the setting and development of fruit on the spur. A total of 9,600 spurs were used as material, an average of 320 spurs per tree from 10 trees each of Jonathan, Grimes, and Wagener apple varieties. Five spur conditions were studied, complete defoliation, all but one leaf removed, all but two leaves removed, no leaves removed, and no leaves removed but deflorated.

A study of the statistical and chemical data, presented in graphical and tabular form, emphasizes the fact that the setting of fruit in the apple is determined, in large measure, by the amount of foliage on the spur. The percentage of fruit was directly in accordance with amount of defoliation; however, in

some instances fruit set on completely defoliated spurs, showing that despite the marked individuality of the spur it obtained food from the tree as a whole. Grimes spurs were able, under complete defoliation, to set more fruit than either Wagener or Jonathan. Defloration without defoliation uniformly increased the leaf area of the spur.

As a result of defoliation, the chemical composition of spurs was altered in the following ways: (1) Total solids decreased, though evidently not in exact proportion to the amount of treatment; (2) no apparent effect was noted in total amounts of soluble sugars, including both reducing sugars and sucrose; (3) hydrolyzable polysaccharids increased with reduction of leaf area; (4) total nitrogen decreased in proportion to defoliation, and a fair correlation was established between leaf area and total nitrogen. Defoliation caused a rather consistent increase in the carbohydrate-nitrogen ratio. The possible cause and value of this change in the ratio is discussed.

Factors influencing fruit-bud development and fruit setting, E. J. KRAUS (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 32–39, fig. 1*).—A paper discussing the application of the author's carbohydrate-nitrogen theory (E. S. R., 40, p. 40) to actual orchard practices, pruning, cultivation, planting of cover crops, and fertilization.

When is pruning profitable? E. J. KRAUS (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 51–55*).—A paper discussing the principles of pruning, with emphasis on the bearing of the carbohydrate-nitrogen theory on the science of pruning. The necessity of adapting the style of pruning to the material at hand is pointed out, and suggestions are given for handling filler trees, permanent trees, and those needing renovation. A method of summer pruning is outlined which the author asserts has been successful in promoting earlier bearing.

Off-year apple bearing, R. H. ROBERTS (*Minn. Hort., 49 (1921), No. 4, pp. 102–106, figs. 2*).—A discussion of the factors influencing annual and biennial bearing in the apple, based on a previously noted bulletin by the same author (E. S. R., 44, p. 41).

Ten-year yield record of apples, C. W. ELLENWOOD (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 40–45, fig. 1*).—A tabulation of phenological and yield data collected during the period 1910–1919 on 93 apple varieties fruiting in the station orchard.

Apple-orchard fertilization, F. H. BALLOU (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 13–16*).—A paper discussing the principles of orchard fertilization as applicable to the poor upland soils of southern Ohio, and presenting a summary of the results of the Ohio Experiment Station projects along these lines. A bulletin upon these by the author and Lewis has been previously noted (E. S. R., 43, p. 647.)

[Memorial to the Rome Beauty apple] (*Ohio State Hort. Soc. Ann. Rpt. 53 (1920), pp. 4–8, fig. 1*).—An important feature of the summer meeting of the Ohio State Horticultural Society, held at Proctorville, Ohio, July 23, 1919, was the dedication of a memorial to the Rome Beauty apple. Information concerning the origin and early history of the variety is presented.

Bush fruits, J. OSKAMP (*Missouri Fruit Sta. Circ. 19 (1921), pp. 12, figs. 9*).—Practical information is given on the culture, pruning, propagation, diseases and insect pests, and varieties of raspberries, blackberries, gooseberries, and currants.

The cultivation of citrus fruits in Porto Rico, F. S. EARLE (*Porto Rico Dept. Agr. and Labor Sta. Circ. 28 (1920), pp. 3–20*).—A circular of practical information for the citrus grower of Porto Rico, discussing location, planting,

stocks, varieties, cultivation and management, diseases, insect pests, and marketing.

Citrus culture in China, H. A. LEE (*Calif. Univ. Jour. Agr., 7 (1921), No. 5, pp. 3–6, figs. 3*).—A popular article presenting the author's observations on the citrus-growing industry in the Canton Delta of China, with special reference to varieties and cultural practices.

Experiments on manuring of coconuts at Long Island and general observations on manuring in Seychelles, P. R. DUPONT (*Seychelles Ann. Rpt. Agr. and Crown Lands, 1919, pp. 5, 6*).—A tabulation of three years' yield records from plats receiving various manurial treatments indicates the value of potash in increasing the yield of coconuts.

The culture of medicinal plants, H. ZORNIG (*Der Anbau von Arzneipflanzen. Munich: Franz Josef Völler, 1920, pp. 112*).—A general discussion of the medicinal plant industry of Germany with special reference to cultivated species, and including a list of wild medicinal herbs and a harvest calendar. The status of medicinal plant culture in many nations is reviewed, and it is pointed out that Germany has in the past produced but a small part of her requirements. The need of remedying this situation is emphasized. Cultural requirements, selection of species, curing, possible occupation for wounded men, and returns are discussed, and cultural and descriptive notes for 52 species included. Numerous references to the literature are cited.

Nantucket wild flowers, A. O. ALBERTSON (*New York and London: G. P. Putnam's Sons, 1921, pp. XLV+442, pls. 8, figs. 100*).—A small illustrated manual of the wild flora of Nantucket, systematically arranged by botanical families and species. A key showing the main characteristics of the families is included.

FORESTRY.

[Reports of the] division of lands and forests (*N. Y. State Conserv. Comn. Ann. Rpts., 9 (1919), pp. 85–174, figs. 41; 10 (1920), pp. 127–199, figs. 33*).—Reports for the calendar years 1919 and 1920 relative to the activities of the New York State division of lands and forests are given, including information relative to the forest preserve and its development from a recreational viewpoint, forest fire protection, reforestation, forest nurseries, control of white pine blister rust, State-wide forestry activities, fire losses, additions to the forest area, and the sale of forest products.

Reports of the Minister of Lands, Forests, and Mines of the Province of Ontario for the [three] years ending October 31, 1919, G. H. FERGUSON (*Min. Lands, Forests, and Mines, Ontario Rpts., 1917, pp. XV+158, figs. 28; 1918, pp. [4]+166, figs. 37; 1919, pp. 228, figs. 39*).—Brief accounts are given of the activities of the Forestry Branch for the three years ended October 31, 1919, including forest protection, reforestation, and forest pathology. The report for 1919 contains a preliminary account of a survey of timber tree diseases of Ontario, especially those occurring in the Timagami Forest Reserve. Besides discovering many diseases not known to occur in Ontario, two new forms were found.

Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1919–20, D. O. WITT (*Bihar and Orissa Forest Admin., Ann. Rpt., 1919–20, pp. II+[62]*).—The usual annual administrative report (E. S. R., 44, p. 641).

Forest firewardens' manual (*Trenton, N. J.: Dept. Conserv. and Development, 1920, pp. 40*).—A small handbook of forest fire regulations and laws prepared for the use of fire wardens of New Jersey and other interested parties.

Forest investigations, O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 39–43*).—A test of forest, shade, and ornamental trees and shrubs at the

Edgeley Substation is reported, and notes are given of those species which have proved satisfactory. Instructions are presented for the establishment of windbreaks with attention to selection of plant materials, planting, and care of the young trees. A comparative study of northern *v.* southern grown nursery stock strongly indicated the superior value of the former.

Forest planting in Ohio, E. SECREST (*Ohio Sta. Mo. Bul., 6 (1921), No 3–4, pp. 51–58*).—A brief article emphasizing the advisability of utilizing the idle and waste lands of Ohio for forestry purposes. The author points out the necessity of selecting species suited to conditions and not simply using personal preferences. Mixed plantings are discussed but, as a general practice, it is advised to plant trees of a single species. The more important hardwood, post-timber, and coniferous species are described, and their special soil requirements noted. Mention is made of several undesirable species.

West Virginia trees, A. B. BROOKS (*West Virginia Sta. Bul. 175 (1920), pp. 242, figs. 116*).—A manual of the trees of West Virginia, in which 101 native species are described and their leaves and fruits accurately delineated. A key to the genera, based on leaves and fruit, is presented. Drawings of 14 important introduced species are included, together with a list of native shrubs and shrubby vines.

Diameter growth in box elder and blue spruce, C. F. KORSTIAN (*Bot. Gaz. 71 (1921), No. 6, pp. 454–461, figs. 3*).—A report of a study of the date and rate of increase in the trunk diameter of the box elder and blue spruce, conducted in Utah in 1920 with the aid of the MacDougal dendrograph. Diagrams are shown illustrating graphically the daily change in diameter of the trunks of both species.

"No direct correlation between the march of diameter growth and current temperatures was found. A careful study of the graphs leads to the inference that the growth response lags behind the temperature, a marked drop in the temperature causing a decrease in or even a cessation of growth. . . . The most interesting fundamental principle of growth exhibited by the records obtained from the box elder and the blue spruce trees is that growth evidently does not begin in deciduous hardwood trees and in evergreen conifers at the same time. . . . It can be seen, therefore, that a determination of the beginning and ending of the period of actual growth will suggest the time during which peeling can be accomplished most easily."

The walnut, F. LESOUED (*Le Noyer. Paris: Libr. Agr. Maison Rustique, 1920, pp. 186, figs. 52*).—A small manual on the Persian walnut (*Juglans regia*), with attention to its botany, varieties, cultural operations, harvesting and handling the nuts and various by-products, insect and fungus pests, etc.

DISEASES OF PLANTS.

Colorado plant diseases, J. G. LEACH (*Colorado Sta. Bul. 259 (1921), pp. 96, pls. 3, figs. 76*).—This is a popular description of the nature of plant diseases and the agencies which produce them, and accounts are given of a number of the specific diseases occurring on Colorado crop plants. In addition, the general principles of plant-disease control and formulae for the preparation and application of standard fungicides for seed treatment are described.

Plant pathology (*Idaho Sta. Bul. 122 (1921), pp. 41–44*).—Brief reports are given of investigations on the relation of soil-moisture content to bunt infection in wheat, calico and russet dwarf disease of potatoes, seed treatment for the control of Rhizoctonia, western yellow tomato blight, and oat smut control. Experiments on bunt infection in wheat showed that the higher the percentage of moisture in the soil, the greater will be the development of smut in the result-

ing crop. The effect of soil temperatures is also being investigated, and it has been found possible to secure some infection at a temperature of 27° C. (80.6° F.), which is higher than the maximum previously reported for the germination of the spores of this organism.

Some preliminary work on the calico and russet dwarf of potatoes was carried on in 1919 and 1920, and both diseases were found quite prevalent in the southern part of the State. Both diseases have been found to be transmitted by means of the seed tubers. Preliminary trials in the greenhouse are believed to indicate that the diseased tops of plants infected with russet dwarf do not carry the disease to succeeding crops. The symptoms of russet dwarf are considered to indicate that the disease may be a bacterial infection.

Tests were made of fungicides as a treatment of seed potatoes for the control of Rhizoctonia, mercuric chlorid and hot formaldehyde being tested. Neither of the treatments as applied proved to be of special value for the control of the disease, and the yield was considerably reduced where hot formaldehyde was employed. Mercuric cyanid was tested in comparison with mercuric chlorid, but the results were not satisfactory.

In studies of the western yellow tomato blight a species of Fusarium was constantly isolated from the roots of diseased plants, and it has been shown that experiments with this organism may cause a serious damping-off of seedlings in the greenhouse, and also cause serious injury to the root systems of mature plants. Several varieties of tomatoes, which were selected for resistance to the eastern type of Fusarium wilt, were grown to determine their resistance to the western disease, but none were as resistant as the varieties commonly grown in the locality.

For the control of oat smut, the use of 10 parts of water to 1 part of formaldehyde is recommended, perfect control having been secured by this modified method of treatment.

[Investigations on plant diseases], G. H. Coons (*Michigan Sta. Rpt. 1919, pp. 259–264*).—The author gives a preliminary report on a study of means for the identification and classification of some of the fungi imperfecti. About 50 cultures of organisms of the Sphaeropsidales have been maintained in cultures, and certain peculiarities of growth have been noted which it is thought will be of value in their diagnosis. He is also testing some of them by means of biological preparations injected into experimental animals. It has already been found that guinea pigs sensitized with *Fusarium conglutinans* will not respond to *F. conglutinans callistephi.*

Further work with the treatment of potato tubers for the control of scab, black scurf, blackleg, etc., has confirmed the previous conclusions (E. S. R., 41, p. 654) that the time for soaking the tubers in formalin or corrosive sublimate solutions may be very materially reduced. Experiments are briefly reported on the use of mercuric cyanid 1:1000 as a substitute for corrosive sublimate. The solution proved efficient for the treatment of tubers and has the decided advantage of being quite soluble and not corrosive to metals.

An account is given of work on the disease of celery to which the name celery stunt is applied. This disease is quite prevalent, occurring in every muck area of the State. The variety Golden Self-blanching is chiefly affected, and it is believed that this plant will soon become exceedingly scarce on the market. The cause of the disease does not appear to have been determined. Some additional studies have been made of the root rot of celery due to *Phoma apiicola*, the causal organism having been grown in pure culture, its physiological relations determined, and the details of methods of infection ascertained. Three strains of the organism have been recognized which differ greatly in virulence.

Some additional information is given regarding the use of formaldehyde for the treatment of grain for the prevention of disease. It has been found that formaldehyde as applied to grain by the wet method polymerizes readily, and that it has a remarkable affinity for water and can not be driven out of water by boiling.

Some investigations on bean mosaic have confirmed the statements that the disease is carried by the seed. Observations made by the author showed that the most pronounced mottling occurred on the new leaves and on the parts of the leaf nearest the veins, indicating possibly that the virus of disease is transferred through the vascular system. Attention is called to the fact that the variety of bean Robust developed at the station is quite resistant to mosaic.

[Report of the] department of botany and plant pathology (*North Dakota Sta. Bul. 146 (1921), pp. 34, 35, 37, 38*).—It is reported that a number of different strains of Fusaria causing wheat scab have been obtained and that studies on the determination of the biologic specialization of the organisms are in progress. Histological studies have shown that the wheat scab fungus penetrates the endosperms as well as the embryo of the wheat seed. All the common varieties of wheat tested seemed to be attacked by wheat scab organisms, although some varieties showed greater resistance to wheat scab than others. Observations on Helminthosporium showed that the disease varies in intensity on different varieties of wheat, and that blade infections are less severe on wheat than on barley.

Some work on disease control was reported, and for wheat scab the necessity of rotation and the careful selection of corn for planting purposes is pointed out. Particular attention should be paid to corn as this plant is thought to be subject to attack by the wheat Fusarium. Notes are given on diseases of potatoes, particularly Rhizoctonia scab and Fusarium wilt, with suggestions for their control.

Division of plant pathology, F. D. Heald (*Washington Sta. Bul. 158 (1920), pp. 30–32*).—The author reports a continuation of studies on the relation of spore load of individual wheat grains to the percentage of smut in the subsequent crop. Varying quantities of smut were applied to grains up to 12,000 spores per grain, but the maximum percentage of smut observed was 5.49, while a considerable number of plantings remained entirely free from the disease.

Considerable difference in susceptibility of varieties was observed. Marquis, which carried as high as 842 spores per grain, produced only a single sample of smut, while other varieties showed a higher percentage of smut, indicating greater need of seed treatment. Final tests of 116 varieties of winter wheat for comparative resistance to smut were made and none were found to be entirely smut free, but the strains of Turkey Red continued to show the least smut.

Weekly plantings of heavily smutted seed from August 1 to November 21 showed a maximum occurrence of smut when sown on October 3. Clean treated seed on summer fallow planted at weekly intervals for the same period showed no smut until the plantings of September 12, when 4.5 per cent was observed, increasing to a maximum of 20.64 per cent on September 26. Plantings from October 24 to November 21 were entirely without smut.

A brief report is made on seed treatments for the prevention of smut, copper sulphate and copper sulphate salt formulas giving clean crops. Low concentrations of formaldehyde produced crops entirely free from smut. In treating seed with formaldehyde the author found that seed injury varied with different lots of seeds, showing the importance of preliminary tests of germination, and

that formaldehyde injury could be greatly reduced by the limewater bath following treatment.

A plant disease survey is reported upon and a number of diseases added to the list already known to occur in Washington. Some special investigations were carried on with two of the new troubles, skin spot of the potato, due to *Oospora pustulans*, and the moldy core of Stayman Winesap apples. A number of different fungi were found in the core cavities, but only two species, Penicillium and Alternaria, were proved capable of causing a rot which advances outwardly into the pulp.

[Investigations in plant pathology] (*Wisconsin Sta. Bul. 323 (1920), pp. 59–73, figs. 7*).—The investigations of tobacco diseases have been continued by J. Johnson. It is reported that the wilt disease of tobacco, first observed in Maryland (E. S. R., 42, p. 247), is known to occur in Wisconsin, but that varieties differ markedly in their resistance to the disease, the Wisconsin types being about 99 per cent resistant as compared with 32 per cent resistance for White Burley. The brown root rot of tobacco is being studied, but the author was unable to discover any causal organism, although from the appearance of the disease it is evidently due to a parasite. The name brown rot is given this disease because the decayed roots are distinctly brown as contrasted with the black root rot due to *Thielavia basicola*. Various legume plants, potatoes, tomatoes, etc., are attacked by this disease, but they are less susceptible than tobacco. So far no resistant varieties of plants have been found, although there is some indication of a less degree of susceptibility on the part of some varieties.

Continued observations are being made at the station on cabbage yellows, and L. R. Jones and assistants have found that the yellows fungus does not develop in cabbage when the soil temperatures are below 61° or above 93° F. The best temperature for the development of the fungus was found to range from 77° to 84° F., which is somewhat above the optimum temperature for the growth of the plant. It has been found that the strains of cabbage resistant to the yellows may in the early stages prove susceptible to the attack of the fungus, but with increasing age the resistant character is intensified. The relation of the development of yellows in cabbage seedlings to variations in soil moisture has been studied, and it was found that the degree of moisture most favorable to the development of the host plant was also most favorable for the growth of the fungus. According to the report, a standard winter variety and two kraut varieties of cabbage developed by the station are now in commercial use. Attention is called to black rot of cabbage, which is sometimes mistaken for cabbage yellows. This disease is said to be commonly carried by seed and first shows as blackened threads on the seed leaves in the seed bed. Hot weather holds the disease in check, but it may become destructive early in the fall. The disease is caused by bacteria occurring on infected seed, and it is recommended that all seed be treated with a solution of corrosive sublimate, 1:1,000, before planting, and after treating with the fungicide from 20 to 30 minutes that it be dried and planted at once.

Further investigations by G. W. Keitt have shown the perfect control of the cherry leaf spot by spraying with Bordeaux mixture and lime sulphur immediately after the petals fall, the application to be repeated after an interval of two weeks. Bordeaux mixture gives a somewhat better control than lime sulphur, but it causes some leaf injury and defoliation. For the control of apple scab, experiments are in progress which indicate that leaves vary greatly in their susceptibility to the attack of the fungus at different stages in their development. The foliage of different varieties also shows a difference in response to the attacks of the fungus. Spraying experiments have shown in general that lime sulphur gives satisfactory results, while Bordeaux mixture

causes a heavy russeting of varieties that are most susceptible to this type of injury.

A bacterial spot of Lima beans was observed by W. B. Tisdale, near Racine, in 1917, and later the same disease was found at Madison. The disease spreads to the upper leaves throughout the season and by the latter part of August the plants are said to be so badly infected that many of the blossoms and young buds are shed. The disease reappeared in 1919 and 1920, and a study of the disease under greenhouse and field conditions is in progress.

The bacterial blackleg of potato, long known in Germany, was observed in Wisconsin in fields of Early Ohio potatoes, J. Monteith reporting as high as 26 per cent of the plants showing presence of the disease.

J. C. Walker is continuing his studies on onion diseases and has found that red and yellow onions are highly resistant to onion smudge, while white varieties are very susceptible. Extracts from colored onions are found to be very toxic to the spores of the parasite which causes the disease, while those from white onion are not, and efforts are being made to isolate the compound which is responsible for this resistance.

The effect of dry heat upon seed germination and disease control has been further tested by J. G. Dickson, and barley was found to withstand heating for longer periods than wheat without injury to germination or reduction of vigor. Wheat germinates after long periods of heating, but yields are said to be greatly reduced. It is reported that a three-hour treatment of 100° C. controlled wheat scab and seedling blight and greatly reduced the smuts of these crops. This period of exposure, however, proved too short to kill the fungus of the organism of barley stripe within the seed. Soaking the seed in formaldehyde, followed by the dry-heat treatment, is believed to promise success in controlling the stripe disease.

An account is given of the wheat scab, blight of wheat seedlings, and root rot of corn, all of which are due to attacks by the same organism. For the control of this disease Dickson recommends planting wheat as early in the spring as possible or as late in the fall as is safe, both plantings apparently controlling the seedling blight. On the other hand, corn should not be planted until the last safe date, or until the soil has become considerably warmed.

Some further studies on the cucumber mosaic by S. P. Doolittle have demonstrated that the wild milkweed (*Asclepias syriaca*) is a host for this disease, and that it may be transferred from one plant to another by aphids as well as by the striped cucumber beetle.

A study of certain fusarial diseases of plants, E. F. Hopkins (*Missouri Sta. Bul. 179 (1921), p. 21*).—The author briefly reports investigations on corn root rot and wheat scab. The experimental results obtained are said to indicate that corn seed from an apparently healthy ear may harbor fungus mycelium near the tip of the grain in the darkened layer covering the scutellum. Six different organisms are said to have been associated with these infected areas, and some of them were found capable of invading the tissue of living, healthy corn roots under laboratory conditions.

The work on wheat scab has included a survey of the State to determine the distribution and amount of damage done. Isolations of the fungus from specimens of scabby wheat received from different parts of the State showed that 75 per cent were pure cultures from a Fusarium of the Giberella type, and over half of them produced perithecia of *G. saubinettii* in culture.

Seed-coat injury and viability of seeds of wheat and barley as factors in susceptibility to molds and fungicides, A. M. Hurd (*Jour. Agr. Research [U. S.], 21 (1921), No 2, pp. 99–122, pls. 11*).—The author gives the results of a cooperative study between the California Experiment Station and the Bureau of

Plant Industry of the U. S. Department of Agriculture, in which some of the factors, especially the physical condition of the seed coats, which enable saprophytes to attack seed, and the relation of mechanical injuries sustained by the seed coat, and treatment of injury are investigated. The fungi used for experimental infections were *Penicillium* sp. and *Rhizopus nigricans*.

The author found that unbroken seed coats ordinarily afford absolute protection against attack by the above-mentioned molds. Infections of such seeds may be obtained, however, by retarding germination of the seed by means of low temperatures. Breaks in the seed coat determine the ability of saprophytic fungi to invade seeds, either in the soil, in storage, or in blotter germinations. If the injury to the seed coat was over the endosperm, 100 per cent fatal infections resulted when spores were present, but if the injury was over the embryo, the seed remained practically immune to attack. Death or injury to seed resulting from seed treatment, or other cause, was found to render previously immune seeds susceptible to fungus invasion.

The effect of copper sulphate on wheat and barley, particularly with reference to the condition of the seed coats, was investigated, and where breaks in the testa over the endosperm of wheat were observed, no injury followed short exposure to copper sulphate. Similar breaks over the embryo, however, resulted in its death after exposures of only 3 to 5 minutes. When seed coats were badly injured, liming did not prevent extreme injury. Stunted roots, rather than injured plumules, are said to be characteristic of copper sulphate injury, because machine thrashing usually breaks the seed coat over the radicle. The amount of damage that will be done to seed wheat by the copper sulphate treatment can be predicted by an examination of the physical condition of the seed. Perfect seed coats were also found an absolute protection against short exposures to strong formaldehyde solutions and a partial protection against post-treatment injury after disinfection with formadehyde.

The inheritance of rust resistance in a family derived from a cross between durum and common wheat, L. R. Waldron (*North Dakota Sta. Bul. 147 (1921), pp. 3–24, figs. 2*).—This bulletin deals with the genetics of resistance and susceptibility of stem rust in a series of plants which arose from a cross between Kubanka, an amber durum, and Power Fife, a hard red spring wheat. The cross was made in 1908, and a number of types were selected and studied in 1916.

The plants were separated into two groups, resistant and nonresistant. Eight plants selected from the more heavily rusted group proved to be heterozygous in later generations, and families were isolated which bred true to resistance and susceptibility. The plants heterozygous to rust resistance were found intermediate in their behavior toward susceptibility and resistance, and the author considers that more than one factor is responsible for resistance to rust. Linkage was found to occur between the characters defining durum wheat and resistance to stem rust, and a similar condition is considered to exist in regard to common wheat and susceptibility to stem rust. It is suggested that a simultaneous crossing over may explain a common wheat type heterozygous to resistance to stem rust and conditioned by at least two factors.

Flag smut of wheat and its control, W. H. Tisdale and M. A. Griffiths (*U. S. Dept. Agr., Farmers' Bul. 1213 (1921), pp. 6, figs. 2*).—This disease, which was first observed in the United States in the vicinity of Granite City, Ill., in 1919, has spread somewhat, and in 1920 flag smut was found in the same region in 111 fields, comprising 2,500 acres. This disease has long been known in the wheat-growing sections of Australia, also in Japan, India, and South Africa. It is characterized by black stripes which run lengthwise in the leaf blades and sheaths. The stems are also affected to some extent, and infected plants

are more or less dwarfed and rarely head out or produce seed. Flag smut is said to spread in two ways, by spores clinging to the seed and by means of spores in the soil. It is not known, however, how long the spores may retain their vitality in the soil.

In cooperation between the U. S. Department of Agriculture and the Illinois State Department of Agriculture, steps have been taken to prevent the spread of flag smut beyond the quarantined area in Madison, Ill., and to eradicate it if possible. The measures adopted include the treatment of all grain with formaldehyde as it comes from the separator, burning all straw, sowing no wheat on infested land, obtaining seed from localities known to be free from flag smut, and the treatment of all seed to be sown with copper sulphate. Marked differences have been observed in the susceptibility to this disease of several varieties.

Bacterial leaf-spot disease of celery, I. C. JAGGER (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 185–188, pls. 2*).—In a previous publication (E. S. R., 33, p. 245) the author briefly described a disease of celery, due to an undetermined species of bacteria. In the present paper, which is a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, a more extended account is given of this disease, which is said to be due to *Pseudomonas apii*, n. sp., a technical description of which is given. As the result of spraying experiments carried on in a number of localities, it is claimed that the disease may be satisfactorily controlled by spraying with Bordeaux mixture, but not by the use of lime-sulphur solution.

Cotton diseases and their control, W. W. GILBERT (*U. S. Dept. Agr., Farmers' Bul. 1187 (1921), pp. 32, figs. 18*).—Popular descriptions are given of wilt, root-knot, anthracnose, bacterial blight, shedding of bolls, rust, sore-shin, and Texas root-rot of cotton, and suggestions given for their control. In addition, a brief description is given of a number of minor diseases of the cotton plant.

Cotton root rot in the San Antonio rotations, C. S. SCOFIELD (*Jour. Agr. Research [U. S.], 21 (1921), No 3, pp. 117–125*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author discusses the crop rotation experiments carried on at San Antonio, Tex., in relation to the occurrence of cotton root rot in certain plats. Observations have been made since 1912 on the occurrence of the disease, and from a study of the history of the plats the author comes to the conclusion that the control of root rot can not be brought about by any ordinary system of crop rotation or by tillage methods.

The lettuce drop due to Sclerotinia minor, W. S. BEACH (*Pennsylvania Sta. Bul. 165 (1921), pp. 27, figs. 6*).—A general account is given of drop disease of lettuce due to *S. minor*, a technical description of which has been previously noted (E. S. R., 44, p. 643).

This disease has been under observation by the author since 1918, when it was first noticed in Philadelphia County, Pa., where it was attacking lettuce grown in open fields. It has also been observed on lettuce grown in cold frames, but in this case the fungus appeared less aggressive than *Botrytis* sp. or *S. libertiana*. The author claims that, though limited in distribution, *S. minor* may surpass either *S. libertiana* or *Botrytis* sp. as a destroyer of lettuce. *S. minor* also attacks celery to a small extent, but is poorly adapted to vegetables in winter storage. When the different types of lettuce drop are compared, the author claims that *S. minor* can occur under drier or more unfavorable conditions and thus it appears more regularly, but that its rate of dissemination is slower, its seasonal prevalence different, and its distribution more local than in the case of *S. libertiana*. Under open field conditions, rotation of crops, de-

struction of old plants, rubbish, etc., roguing, and soil disinfection are recommended.

Cultural and morphological studies of *S. minor* are given in some detail.

Pink root disease of onions and its control in Texas, J. J. TAUBENHAUS and F. W. MALLY (*Texas Sta. Bul. 273 (1921), pp. 3–42, figs. 3*).—A detailed report is given of investigations on the pink root disease of onions and its control, preliminary accounts and the cause of the disease, which is due to *Fusarium malli*, having been previously noted (E. S. R., 37, p. 841; 40, p. 643). The rotation of crops has been found beneficial in reducing the amount of pink root, although it will not altogether eliminate the fungus from the soil. All onionlike plants should be excluded from rotations, and at least a three or four-year rotation is recommended.

Straighthead of rice and its control, W. H. TISDALE and J. M. JENKINS (*U. S. Dept. Agr., Farmers' Bul. 1212 (1921), pp. 16, figs. 7*).—A description is given of straighthead of rice, which is said to be one of the most destructive diseases of rice in the southern part of the United States. The investigations, which were in cooperation with the Louisiana Stations, show that straighthead is caused by certain unfavorable soil conditions and is most prevalent on virgin soil, especially on land in which nonirrigated crops have been grown for a number of years preceding the rice crop. All parts of the plant are affected, including the root system. The leaves are said to be darker green and somewhat stiffer than normal leaves. One or both glumes in a flower may be absent and the flower remain sterile. In severe cases the plants fail to head.

Straighthead can be prevented by the proper aeration of soils which are in a condition to reduce the disease. The authors recommend for the prevention of this trouble irrigation of the rice about 10 days after the plants emerge. If symptoms of the disease appear the land should be drained six weeks after irrigation and allowed to dry for two or three weeks. When the plants begin to turn yellow and show signs of wilting, water should again be applied and retained for the remainder of the season.

Sugar-cane diseases, C. W. EDGERTON and C. C. MORELAND (*Louisiana Stas. Rpt. 1920, pp. 16, 17*).—Notes are given on sugar-cane diseases observed by the authors during the year, and attention is called to the fact that the mosaic disease spread very rapidly during 1920. There is said to be now a very heavy infection all along the river plantations, the disease is present to a considerable extent along Bayou Lafourche, and it is also appearing in isolated places in the western part of the sugar belt of the State. Recent observations are said to bear out those of previous years that the L–511 seedling is the most resistant to mosaic disease of any of the important varieties of the State. Experiments show that the D–95 cane is extremely susceptible to the mosaic disease.

A dangerous tobacco disease appears in the United States, E. F. SMITH and R. E. B. MCKENNEY (*U. S. Dept. Agr., Dept. Circ. 174 (1921), pp. 6*).—In response to an urgent request of Florida tobacco growers, an investigation was made the latter part of March, 1921, of seed beds near Quincy, Fla. These beds were found badly infected with a mildew that is different from any tobacco disease previously observed in the United States. Further investigation showed that the disease was present not only in Florida but had spread to Decatur County, Ga., and by April 14 it was considered probable that all the seed beds in Gadsden County, Fla., and Decatur County, Ga., were more or less infected.

The disease is said to be apparently due to *Peronospora hyoscyami*, originally described from the black nightshade in Europe. The same fungus has been reported in tobacco seed beds in Australia and in South Africa, and as occurring in the wild tobacco plants in southern California. Preliminary to other

investigations the authors recommend for the control of this disease the use of sterilized soil in seed beds, seed of undoubted purity, and hygienic measures in the care of seedlings. It is also believed that plants from infected beds should not be set in the field. Attention is called to this disease so that tobacco planters throughout other regions of the United States may be on their guard against its introduction.

Suggestions to growers for treatment of tobacco blue-mold disease in the Georgia-Florida district, E. F. SMITH and R. E. B. MCKENNEY (*U. S. Dept. Agr., Dept. Circ. 176 (1921), pp. 4*).—In view of the possible seriousness of the downy mildew on tobacco, reported above, the authors suggest seed bed and field treatments that are believed will be advantageous in holding the disease in check or in eradicating it.

Bacterial spot of tomato, M. W. GARDNER and J. B. KENDRICK (*Jour. Agr. Research [U. S.], 21 (1921), No. 2, pp. 123–156, pls. 5*).—In a contribution from the Indiana Experiment Station, the authors give an account of the symptoms of a bacterial spot of tomato, and the isolation, pathogenicity, cultural characters, overwintering, and dissemination of the causal bacterium.

Bacterial spot of tomato is said to be a typical spot disease of the fruits, stems, and foliage, and practically all varieties of tomatoes have been found susceptible. Peppers and potatoes are also susceptible to some degree. The worst damage is due to the fruit lesions, although the disease is somewhat destructive among seedlings and occasionally as a foliage trouble in the field. The organism has been isolated and designated as a new species named *Bacterium exitiosum*. Foliage infection by atomizer inoculation is said to be readily obtained. Fruit infection occurs only through punctured wounds. Inoculation of mature fruit is usually unsuccessful, and this is attributed to the fact that the mature fruits have a higher hydrogen-ion concentration than the immature fruits or foliage. The organism is said to overwinter on the surface of tomato seed, and the disease may also be disseminated with diseased transplants. As a control measure disinfection of tomato seed in mercuric chlorid (1:3,000) for five minutes, to be followed by thorough washing, is recommended.

Tomato bacterial spot and seed disinfection, M. W. GARDNER and J. B. KENDRICK (*Indiana Sta. Bul. 251 (1921), pp. 15, figs. 10*).—This is a nontechnical bulletin describing results of investigations noted above.

Botrytis rot and wilt of tomato, R. C. THOMAS (*Ohio Sta. Mo. Bul. 6 (1921), No. 3–4, pp. 59–62, figs. 3*).—A popular account is given of the occurrenec of a blossom-end rot of tomatoes under greenhouse conditions, which is also characterized by a wilt of the plants due to a girdling of the stems by the organism.

Infected tomatoes are said to have shown water-soaked spots which became slightly sunken and spread rapidly. Later the decaying portions turned ashy gray and finally brown in color. After the invasion of the stem end of the fruit had become general the larger fruits became detached, but frequently before this occurred the fungus had spread through the fruit spur and the main stalk girdling it, resulting in a rapid wilt of the distal portion of the plant. Inoculation experiments with water-spore suspension of the fungus failed to produce disease, but when pieces of diseased plant tissue were placed in contact with the stalks of healthy plants infection occurred after five days in a moist atmosphere. The results obtained are believed to indicate that infection develops only after the Botrytis fungus has survived for any time as a saprophyte. For the control of this disease the author suggests the avoidance of excessive watering and the giving of sufficient ventilation to lower the atmospheric moisture content.

Collar rot of tomato, F. J. PRITCHARD and W. S. PORTE (*Jour. Agr. Research [U. S.], 21 (1921), No 3, pp. 179–184, pls. 5*).—The results are given of investigations carried on in the Bureau of Plant Industry, U. S. Department of Agriculture, of a new disease of tomato seedlings which took the form of a rotting and girdling of the stems at the surface of the soil. This disease has been reported for the past three years as causing heavy loss in Maryland, New Jersey, and Delaware. It is said to be chiefly a seed-bed disease, plants infected in the seed bed carrying the disease to the field. Field infections are said to occur, but they are not very common.

From collar rot material a Verticillium was isolated that was found to infect tomato seedlings readily, and the present paper contains results of inoculation experiments with three species, *Verticillium lycopersici*, *Macrosporium solani*, and *Rhizoctonia solani*. The Verticillium proved to be a new species, which is described under the name *V. lycopersici*. The inoculation experiments showed that the collar rot and girdling of stem could be produced by all three of the fungi investigated, *V. lycopersici* and *M. solani* infecting tomato seedlings about equally well and causing typical lesions on 65 to 100 per cent in all plants inoculated, while Rhizoctonia produced a few infections of a superficial nature. The stems of potato and horse nettle were found to be infected by all three fungi, producing collar rot lesions in about the same proportion as mentioned above for the tomato.

Studies on tomato leaf-spot control, W. H. MARTIN (*New Jersey Stas. Bul. 345 (1920), pp. 43, figs. 4*).—Results are given of experiments conducted by the author to determine whether or not the leaf spot of tomatoes, caused by *Septoria lycopersici*, could be controlled by spraying. At the same time, investigations were made to determine the means by which the causal organism was disseminated.

Insects were found to carry large numbers of the spores, and wind and water were likewise found to function in the distribution of the leaf-spot organism. Pickers were found to carry large numbers of the spores on their hands and garments, and as a result the author suggests that picking tomatoes should be delayed after a rain or heavy dew until the plants are quite dry.

Studies on disease control have shown that while increased yields have been secured from the use of Bordeaux mixture, very little control resulted. Formulas of Bordeaux mixture to which soap was added were tested, and the best control was secured with Bordeaux mixture to which 3 lbs. of soap was added. As a result of these investigations, it is claimed that ordinarily it is not necessary to spray plants in the seed bed in New Jersey for the control of leaf spot. It would appear also that early applications in the field are not necessary, but the first application of the fungicide should not be made later than July 1. It is not believed that the presence of Bordeaux mixture on the plant had any direct influence on the ripening period, and under certain conditions the advisability of spraying late varieties of tomatoes is considered questionable. The author claims that leaf spot may be controlled by thorough timely spraying, but a few applications made indiscriminately will not give satisfactory results.

Apple rosette, O. M. MORRIS (*Washington Sta. Bul. 158 (1920), p. 27*).—Surveys are said to have shown that apple rosette does not occur in any orchards other than those on alkali soils, and investigations have demonstrated that the use of legume cover crops in the orchards may cause the trees to recover and resume normal growth. Chemical analyses of badly rosetted twigs, as compared with normal ones, showed that the ash and alkali content of the rosetted material was much higher than that of normal material. All of the work thus far carried on is believed to indicate that the accumulation

of alkaline salts in the apple trees is at least a contributing factor to the development of this abnormal formation.

A bacterial bud rot of cannas, M. K. BRYAN (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 143–152, pls. 8*).—An account is given of bud rot of cannas, a hitherto undescribed disease that has been found to be due to *Bacterium cannae* n. sp. This disease has been studied by the author in the Bureau of Plant Industry of the U. S. Department of Agriculture, since 1918, and is considered to be primarily one of young tissues and moist conditions. Infection takes place through the stomata and spreads through the intercellular spaces of the parenchyma of leaf blade, petiole, and stalk. It is most destructive early in the season and begins in the hothouse and continues in the open beds. It destroys buds, causing formation of large unsightly spots on the leaves, and ruins the blossom clusters by blighting the flower buds or by decaying the stalk. No means for control have been worked out as yet, but it is recommended that healthy stock be selected for planting, that care be observed to avoid crowding and overwatering, and that good ventilation be maintained for plants in the house. Some differences in varietal susceptibility have been noted, and those especially subject to the disease should be discarded.

A chlorosis of conifers corrected by spraying with ferrous sulphate, C. F. KORSTIAN, C. HARTLEY, L. F. WATTS, and G. G. HAHN (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 153–171, figs. 4*).—In a joint contribution from the Forest Service and the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give an account of experiments on the control of chlorosis of conifers in a number of forest nurseries in the western part of the United States.

The disease is said to affect all conifer species grown in the forest nursery in Idaho, and associated with chlorosis was found poor growth of roots, stems, and leaves, failure to form normal terminal buds, and susceptibility to winter injury. Following the successful treatment of pineapple chlorosis with iron sulphate solution (E. S. R., 36, p. 850), the authors sprayed the young conifers with solutions and found that at the Pocatello Nursery chlorosis of the western yellow pine was corrected by spraying with a 1 per cent solution at 10-day intervals. The solution was used in sufficient quantities to wet the tops of the seedlings thoroughly. The 2 per cent solution, while correcting chlorosis, caused chemical injury to practically all the plants. The control of chlorosis in jack pine and western yellow pine at the Morton Nursery in Nebraska by spraying with a 1 per cent solution of iron sulphate was so successful that this method of treatment has been adopted as a regular nursery practice.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Wild ducks and duck foods of the Bear River marshes, Utah, A. WETMORE (*U. S. Dept. Agr. Bul. 936 (1921), pp. 20, pls. 4*).—This is a report on the abundance, food supplies, and general conditions affecting the wild ducks and geese breeding on the Bear River marshes in Utah or frequenting this region at other times of the year before their migrations to other parts of the United States.

The development of entomology in North America, W. J. HOLLAND (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 1–15*).—This is the annual presidential address delivered before the Entomological Society of America at St. Louis, Mo., in December, 1919.

Symposium on the life cycle in insects (*Ann. Ent. Soc. Amer., 13 (1920), No. 2, pp. 133–201, figs. 4*).—The life cycle in insects is dealt with as follows: Apterygota, by J. W. Folsom (pp. 133–137; The Life Cycle of the Orthopteroid Orders, by E. M. Walker (pp. 137–141); The Life Cycle in Hemiptera (Exclud-

ing Aphids and Coccids), by E. D. Ball (pp. 142–155); The Life Cycle of Aphids and Coccids, by E. M. Patch (pp. 156–167); The Life Cycle of the Lepidoptera, by S. B. Fracker (pp. 167–173); The Life Cycle of the Coleoptera (Including the Strepsiptera), by R. N. Chapman (pp. 174–180); The Life Cycle of the Diptera, by C. L. Metcalf (pp. 180–189); Hymenoptera, by T. D. A. Cockerell (pp. 190–192; and The Life Cycle of Insects, General Discussion, by S. A. Forbes (pp. 193–201).

[Report of the entomological work] (*Idaho Sta. Bul. 122 (1921), pp. 33, 34, 38, 39, 40, 41, figs. 1*).—Work with the clover aphis, in continuation of that previously reported (E. S. R., 40, p. 354), has shown that fields may be grazed closely with sheep as late as the first week in July and yet mature a full seed crop. On several fields cut back between July 1 and 15, a small second hay crop was obtained. Both of these measures are effective in preventing the aphids from attacking the seed crop.

Approximately three-fourths of the second-year red clover fields in the lower Snake River Valley were destroyed during the fall and winter by the red clover eelworm (*Tylenchus dipsaci* Kühn). In observations made during June and July, it was determined that infestation by the alfalfa weevil had increased from 15 to 21 counties. Life history studies of the codling moth were made in over 20 orchards from New Plymouth to Weiser. The studies showed that the first brood of moths emerged over a long period, there being really two peaks to the brood, one about June 14 and the other approximately July 1.

In spraying experiments with the San José scale, in which comparative tests were made of the efficiency of a number of standard spray materials, including lime sulphur and miscible oils, all proved to be effective.

Report of the entomological section, R. H. Pettit (*Michigan Sta. Rpt. 1919, pp. 270–277, figs. 8*).—The first part of this report consists of a discussion of the occurrence of some of the more important insect pests of the year, during which a number of unusual insects appeared. The clover jassid or leafhopper (*Agallia sanguinolenta*) occurred in the southern part of the State on clover, and at Centerville destroyed from half to three-fourths of the crop in some fields.

The potato leafhopper, which causes tipburn, was controlled by a spray of nicotin sulphate, applied before the leafhoppers acquired their wings. It is pointed out that, since this insect passes the winter in hiding under rubbish, the destruction of all rubbish in late fall is the one way to gain permanent control.

The spittle insect *Philaenus leucophthalmus fasciatus* was very plentiful on clover at Chatham, in the Upper Peninsula Substation fields. The army worm appeared in several southern counties, while the erratic army worm (*Noctua fennica*) appeared in cut-over districts in the north, but, being confined to non-agricultural sections, it did very little damage except to gardens. A crambid, or grass webworm, injured young corn by boring through the roots and stalks, at the same time spinning webs about the roots. In the campaign against grasshoppers, which for several years have been bad in a number of counties, a poisoned sawdust bait is being used with success. It consists of 1 bu. of hardwood sawdust, 1 lb. white arsenic, 1 lb. (scant) salt, 0.5 pt. molasses, and water to make a stiff mash.

A summary of information on the wheat jointworm (*Isosoma tritici*) is presented by R. H. Pettit and E. McDaniel (pp. 272–276). An outbreak took place during the summer of 1918, which was the third that has been observed in Michigan, the others having occurred in 1884 and in 1905 and 1906. In addition to wheat, rye is sometimes slightly and barley often badly, attacked. Several hundred samples of infested straw from standing grain, collected for the most part from the southern half of the State, were kept under observation

in cages. During the summer thousands of parasites, representing five species, emerged from the straw. The parasites reared, in order of their importance, are *Ditropinotus aureoviridis*, *Homoporus chaloidophagus*, *Eupelmus alynii*, *Eupelminus saltator*, and *Eridontomerus pruinosa*. These parasites were pretty generally distributed over the southern half of the State, the Ditropinotus being by far the most important. Another parasite, *Eurytoma bolteri*, which closely resembles the jointworm itself in the adult stage, was reared from the infested straw. The jointworm situation during 1919 is said to have been markedly improved, whereas the more serious species, known as the sheath jointworm (*I. vaginicola*), which produced comparatively few parasites in cages, was still plentiful and possibly worse than in 1918. *I. vaginicola*, however, was not so widely distributed, being confined more especially to the eastern part of the State.

[Report of the department of] entomology, L. HASEMAN, S. R. MCLANE, and K. C. SULLIVAN (*Missouri Sta. Bul. 179 (1921), pp. 26–30*).—Investigations of the Hessian fly resistant qualities of different varieties of wheat, reported upon in tabular form, show Illinois Chief and Zieglers Choice to be the most resistant, with 5 and 7 per cent infestation, respectively, and Miracle, with an infestation of 50 per cent, to be most susceptible. Observations of the annual life cycle of the Hessian fly substantiate the earlier studies.

Treatment of 13 varieties of corn with arsenate of lead, at the rate of 1 lb. (dry) to 50 gal. of water, and of other plants of these varieties with equal parts of dry arsenate of lead and hydrated lime, for the control of the bollworm, failed to give any special results.

In codling moth studies, tests were made for the amount of lead arsenate placed in calyx cups by the use of different nozzles and at different pressures. It was found that a pressure of from 75 to 150 lbs. and a reasonably fine mist nozzle, like the Disk, would place as much as, or more poison in the inner calyx cup than, a higher pressure and a coarser nozzle.

Reference is made to studies of insects injurious to nursery stock and to insects affecting melon and related crops.

[Report of the] division of entomology and zoology, A. L. MELANDER (*Washington Sta. Bul. 158 (1920), pp. 21–23*).—In spraying work with the codling moth, conducted at Cashmere, Opportunity, and Moran, with a view to determining the relative value of various treatments, the coefficient method of rating, an account of which has been previously noted (E. S. R., 44, p. 655), has shown a slight advantage in favor of the clipper nozzle over the spray-gun at the calyx application. Powdered arsenate of lead gave slightly better results than calcium or magnesium arsenates, and proved somewhat better than the paste form. No scorching was caused by calcium arsenate even where the lime sulphur was omitted. There was not sufficient improvement to warrant use of a spray much stronger than 1 lb. of powdered lead arsenate to 75 gal. The addition of 4 to 6 bars of laundry soap aided materially in increasing the covering ability of the spray. Late sprayings proved to be very necessary in the orchards under treatment, which were selected because of particularly heavy infestation.

Brief reference is made to winterkill of San José scale, a report upon which by Spuler has been noted from another source (E. S. R., 44, p. 654). The leaf roller in the Spokane district was the most startling orchard pest of the year.

[Work with bees and insect pests] (*Wisconsin Sta. Bul. 323 (1920), pp. 42–46, figs. 3*).—The work discussed includes the occurrence of bee diseases in the State, where 8,000 persons kept bees; the cause of winter losses with bees; establishing or restocking apiaries by means of package bees; pea moth investi-

gations, a bulletin relating to which has been noted (E. S. R., 43, p. 257); and the occurrence of several of the more important pests of the year.

A bibliography on fungus insects and their hosts, H. B. WEISS (*Ent. News, 32 (1921), No. 2, pp. 45–47*).—This list, which is arranged by orders and includes only references to American literature, is said to be as complete as is possible to make it.

Additional fungus insects and their hosts, W. B. WEISS and E. WEST (*Biol. Soc. Wash. Proc., 34 (1921), pp. 59–61*).—This supplements the paper previously noted (E. S. R., 43, p. 659).

[Horticultural inspection] (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 160–172; 178–205*).—Papers presented before the Section of Horticultural Inspection of the American Association of Economic Entomologists, at Chicago, December 30, 1920, include the following: The Trend of Horticultural Inspection, by J. G. Sanders (pp. 161–166); Activities of the Federal Horticultural Board on the Texas-Mexican Border, by O. D. Deputy (pp. 178–183); Standardized Nursery Inspection, by F. M. O'Byrne (pp. 183–188); Some Problems in Greenhouse Inspection Work in Indiana, by H. F. Dietz (pp. 188–194); Plant Quarantine Work at Florida Points, by J. H. Montgomery (pp. 195–200); and The Operation of Quarantine No. 37, by R. K. Beattie (pp. 201–204).

Dusting v. spraying of apples, A. L. QUAINTANCE (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 220–225*).—Some of the results obtained by the Bureaus of Entomology and Plant Industry, U. S. Department of Agriculture, during the last few years in dusting apple orchards in comparison with spraying are reported in tabular form. The experiments were conducted at Benton Harbor, Mich., Winchester, Va., Bentonville, Ark., Wallingford, Conn., and Grand Junction, Colo.

The following general conclusions in regard to the codling moth and plum curculio, based upon the work with apples, are considered warranted: "In regions where the codling moth is not especially severe, as in the New England States and other more northern States, dusting controls this insect practically as well or as well as spraying. In regions where the codling moth is more abundant, due to a larger second brood or to subsequent broods of larvae, as in Maryland, Virginia, Illinois, the Ozarks, etc., dusting is not a satisfactory control. In such arid regions as the Grand Valley, Colo., where the codling moth is very prolific and injurious, dusting is notably less effective than spraying.

"In the case of the plum curculio on apples, dusting compares favorably with spraying where the insect is not especially abundant. Under conditions of curculio abundance, as is often the case in orchards in sod, dusting is not an effective control for this insect, and spraying under these conditions may not furnish the protection desired."

It is stated that considerable work has also been done in dusting peaches in comparison with spraying for the control of the plum curculio, scab, and brown rot in different parts of the country, but that little of this work has been entirely satisfactory from the experimental standpoint, owing to the scarcity in the same orchard of one or more of these troubles. "The most conclusive results obtained come from Mississippi and Georgia and indicate that, during periods of average abundance and under average weather conditions, dusting is about as effective as spraying for these three peach troubles."

[Dust mixtures for insect control] (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 205–238, fig. 1*).—Papers on this subject presented in the symposium of the joint meeting of the American Association of Economic Entomologists and the American Phytopathological Society, at Chicago, on December 31, 1920, include the

following: Control of Sucking Insects with Dust Mixtures, by P. J. Parrott (pp. 206–214); Dusting as a Means of Controlling Injurious Insects, by T. J. Headlee (pp. 214–220); Dusting *v.* Spraying of Apples, by A. L. Quaintance (pp. 220–225), noted above; and Orchard Dusting *v.* Spraying, by N. J. Giddings (pp. 225–238).

Insects injurious to deciduous shade trees and their control, J. Kotinsky (*U. S. Dept. Agr., Farmers' Bul. 1169 (1921), pp. 100, figs. 64*).—This is a popular source of information on the more important insects affecting deciduous shade trees in the eastern two-thirds of the United States, excepting the gipsy and brown-tail moths, and means for their control.

A new genus of termite guest from Fiji, W. M. Mann (*Psyche, 28 (1921), No. 2, pp. 54–56 fig. 1*).

The process of hatching in Corydalis cornuta L., R. C. Smith (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 70–74, figs. 2*).

Orthoptera of Maine, A. P. Morse (*Maine Sta. Bul. 296 (1921), pp. 36, figs. 25*).—This is a summary of information on the grasshoppers and related insects occuring in Maine, including an annotated list of 74 forms occurring in the State.

Hippiscus olancha Caud., an apparently undescribed grasshopper from California (Orthop., Acrididae), A. N. Caudell (*Ent. News, 32 (1921), No. 5, pp. 149–151*).

Possible use of a trap to control leafhoppers injurious to fruit trees, G. W. Barber (*Jour. Econ. Ent., 14 (1921), No. 2, p. 240*).—In the course of investigations of the European corn borer at Arlington, Mass., the author found that a macerated grapefruit placed in a cage in a large apple tree was highly attractive to *Empoa rosae*, with which the tree was severely infested. Several days after the bait was placed the cage was completely covered with thousands of adults of the leafhopper. Since the trap was placed on the trunk of the tree 4 ft. from the ground and at least 3 ft. from the nearest foliage, it is concluded that this bait is highly attractive and may be made practical use of.

Some studies on the influence of environmental factors on the hatching of the eggs of Aphis avenae Fab. and A. pomi DeG., A. Peterson (*Ann. Ent. Soc. Amer., 13 (1920), No. 4, pp. 391–401, figs. 6*).—This is a report of studies conducted in connection with investigations previously noted (E. S. R., 42, p. 250).

Note on the rosy aphis, A. C. Baker (*Canad. Ent., 53 (1921), No. 4, p. 95*).—The author records the discovery of the type *Aphis malifoliae* Fitch since the preparation of the paper previously noted (E. S. R., 36, p. 356). He finds that it represents *A. crataegifoliae* Fitch. Since the rosy aphis is without a name, as all former names given it refer to different insects, the name *Anuraphis roseus* is proposed.

The Coccidae, A. D. MacGillivray (*Urbana, Ill.: Scarab Co., 1921, pp. VIII+502*).—This consists of tables for the identification of the subfamilies and some of the more important genera and species, together with discussions of their anatomy and life history. The materials here presented were originally collected for the use of students in the identification of coccids. An introduction is followed by chapters on preparation, external anatomy, and classification, 17 chapters relating to as many subfamilies, and 6 chapters relating to as many tribes. The work includes a bibliography of nine pages and an index to the subject matter, including genera and species.

A review of MacGillivray's The Coccidae, G. F. Ferris (*Canad. Ent., 53 (1921), Nos. 3, pp. 57–61; 4, pp. 91–95*).—A review of the work above noted.

The Coccidae of South Africa, V, C. K. Brain (*Bul. Ent. Research, 11 (1920), No. 1, pp. 1–41, pls. 4*).—In this continuation of papers previously noted

(E. S. R., 44, p. 853), the genera Allopulvinaria, Conofilippia, Idiosaissetia, and Membranaria are erected, and 56 additional forms listed, of which 29 are described as new.

The present status of the gipsy moth in New Jersey, T. J. HEADLEE (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 172–178*).—The author records the occurrence of the gipsy moth in New Jersey at Duke's Park near Somerville, where it was discovered in July, 1920, having been introduced with shipments of blue spruce trees from Europe in 1910 and 1911. Ninety square miles in the Somerville area were found to be scatteringly infested. Intrastate shipments appear to have resulted in infestations at Glen Rock, Wyckoff, Paterson, Elizabeth, South Orange, Mendham, Scotch Plains, and Deal Beach. The work of control now under way is discussed.

The apple leaf-crumpler as a pest of Cotoneaster, H. B. WEISS (*Canad. Ent., 53 (1921), No. 4, pp. 73–75*).—*Mineola indiginella* Zell., which normally feeds on apple, quince, plum, cherry, peach, and pear is recorded as injuring Cotoneaster, notably *C. microphylla* and *C. horizontalis.* in a nursery at Rutherford, N. J., where they are grown as ornamental shrubs.

New synonymy in a recent paper on the European corn borer, C. HEINRICH (*Ent. News, 32 (1921), No. 2, pp. 57, 58*).—This is a discussion of a paper by Flint and Malloch, previously noted (E. S. R., 43, p. 661).

Descriptions of new Central American Microlepidoptera, A. BUSCK (*Insecutor Inscitiae Menstrums, 8 (1920), No. 4–6, pp. 83–95*).

New species of Notodontidae from Central and South America (Lepidoptera), W. SCHAUS (*Insecutor Inscitiae Menstruus, 8 (1920), No. 7–9, pp. 147–161*).

The codling moth: A quandary and a query, G. W. HERRICK (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 156–160*).—The most effective method of control of the codling moth is considered.

Life history of Recurvaria milleri, the lodgepole pine needle-miner, in the Yosemite National Park California, J. E. PATTERSON (*Jour. Agr. Research [U. S.], 21 (1921), No. 3, pp. 127–142, pls. 2, figs. 4*).—The lodgepole pine needle-miner (*R. milleri* Busck) infests the needles of *Pinus murrayana*, causing them to fade and later fall from the trees, resulting in defoliation in the infested areas. The only serious epidemics of the needle-miner which have been recorded occur in the lodgepole pine stands in the Yosemite National Park of California, where the investigation was conducted.

The occurrence of this pest over large areas in the Yosemite Park first came to the attention of the Bureau of Entomology, U. S. Department of Agriculture, in 1903, since which time its infestation has been increasing. Examinations in 1913 and 1914 indicated that the infestation was distributed throughout about 30,000 acres in the park, being limited, however, to lodgepole pine growing between the elevations of 7,000 and 9,000 ft. Much of the timber defoliated by the needle-miner has been attacked and killed by the mountain-pine beetle (*Dendroctonus monticolae*). Final and complete killing of the trees as a result of the needle-miner damage alone has not been recorded, although some of the more severely affected have reached a condition that offers little hope for their ultimate recovery.

"The length of the life cycle is 25 months, and covers a period of one year and parts of two other years. The individual broods hibernate during two winter periods of approximately six months each. The feeding periods of the larvæ occur during parts of three years, aggregating a total period of 11 months. Flight occurs every alternate year, as in 1913, 1915, 1917, and 1919. During the alternate years from flight the broods are found in the larval stage in the needles of the current or previous year's growth." Emergence and flight of the

adults occur during the period from July 1 to August 31. The life cycle of the pest is diagrammatically illustrated.

The eggs are deposited on and under the needle sheaths at the base of the needles, and the larvæ begin to hatch out about August 5 and continue hatching until about September 10. By the latter part of October they have grown to be approximately 2 mm. long and have mined about one-third the outer length of the infested needles. Activity ceases during the latter part of October, and during the winter of the first season the insect hibernates as immature larvæ in the partially mined needles. Activity is resumed in early May of the next spring, and the brood develops as larvæ throughout the growing period of the second season, having mined two-thirds the length of the infested needles by the middle of July. About August 5, when new needles are nearly full-grown, the larvæ begin to leave the mined needles in which the previous winter was passed and migrate to the new needles. During the latter part of October the brood again ceases feeding and becomes dormant, passing the second winter as nearly mature larvæ in the first-attacked needles of the second season's growth. Activity is again resumed the following spring in early May. After completely mining the needles in which they hibernated, the needles are abandoned and the larvæ attack green needles of the same growth, which by the last of May are from one-half to three-fourths mined. The larvæ, now being full-grown, cease feeding and prepare the larval tunnels for pupation in the last-mined needles. Thus, by the time pupation begins, each larva has mined three needles during its life cycle of 23 months. Pupation, which takes place in the mined needles with the heads toward the tips, begins about June 10, and the adults begin to emerge about July 1.

Ten species of hymenopterous parasites have been reared from the prepupal larvæ, of which *Copidosoma* sp. and *Euteles* sp. are most abundant. The author concludes that the use of sprays, etc., in control of the pest is not practicable. It is pointed out that in many sites where the mature lodgepole pine has been killed out by bark-beetle epidemics following in the wake of the needle-miner invasions, mountain hemlock and fir are reproducing to a most encouraging extent, and that these latter species are more desirable for park purposes in many ways and are not subject to the epidemics which are killing the lodgepole pine.

The pecan-nut case bearer (Acrobasis caryaevorella), S. W. Bilsing (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 149–153*).—Spraying experiments conducted over a period of several years in Texas, where *A. caryaevorella* is the most important insect enemy of the pecan industry, have led to the conclusion that it can best be controlled by the use of arsenate of lead against the first of the three generations, applied at the rate of 3 lbs. to 50 gal. of water, under a pressure of 250 lbs. In addition to two applications for the first brood larvae, a third spraying for the second brood, the latter part of June, is sometimes necessary.

Anopheles breeding among water lettuce—a new habitat, J. Zetek (*Bul. Ent. Research, 11 (1920), No. 1, pp. 73–75*) —Attention is called to the importance of floating islands of water lettuce (*Pistia stratiotes*) as a source of malaria infection.

The range crane flies in California, C. M. Packard and B. G. Thompson (*U. S. Dept. Agr., Dept. Circ. 172 (1921), pp. 8, figs. 5*).—This account relates to *Tipula simplex* Doane and *T. quaylii* Doane, the larvae of which badly injure California ranges, pastures, and grain and alfalfa fields during the rainy season. The forage on large areas of range land is often destroyed by the maggots, which sometimes become exceedingly abundant in spots, averaging as many as 300 to the square foot.

The females of both species and the male of *T. quaylii* are wingless. The eggs are deposited late in the winter in small masses mixed with soil, and the larvae hatch out during the first heavy rains of the following winter just as the grasses have sprouted, the eggs having remained dormant in the soil throughout the intervening dry season. By the end of January or early February the larvae become full grown and pupate just below the surface of the soil. The adults emerge in late February or in March and deposit their eggs within a few rods of the spot where they emerge from the ground.

Experiments conducted during the winter of 1920–21 in heavily infested areas resulted in from 50 to 90 per cent of the maggots being killed by the several different poisoned bran formulas tested. An average of 72 per cent of the total number present were killed by the use of the grasshopper formula, consisting of mollasses and lemons added to bran, Paris green, and water, and fully as high a percentage of mortality was obtained by the same formula without any of the flavoring. The results led the authors to recommend the use of 25 lbs. of bran, 1 lb. of Paris green, and sufficient water to make a flaky mash (about 3 gal.). Ten to 20 lbs. per acre of this bait was the smallest amount that gave uniformly high kill over the entire plat. Amounts larger than 20 lbs. per acre did not increase the effectiveness of the bait. When this is evenly and smoothly spread with a grain seeder, effective results can be probably be obtained with smaller amounts than when more or less unevenly sown by hand. "The poison should be sown broadcast over the entire infested area, rather than in strips, because this insect ordinarily does not travel far in search of food. The cost of this poison, applied as recommended above, is about 50 cts. per acre, not counting the labor of mixing and spreading."

On the reasons for the variation in the effects of formaldehyde as a poison for house flies, L. Lloyd (*Bul. Ent. Research, 11 (1920), No. 1, pp. 47–63, figs. 4*).—The author finds the effective action of formaldehyde as a fly poison to depend upon the freedom of the exposed fluid from formic acid, and, to a less extent, from methylamin. "That used for fly poisoning should, therefore, be colorless and free from a fishy odor, and a weak alkali, in slight excess, should be added in dilution to neutralize any acid present and that which will be formed during exposure. The formula recommended is 40 per cent formaldehyde 5 to 6 per cent, clear lime water 50 per cent, sugar 2.5 per cent, and water to make 100 per cent. This should be exposed in a trap which will protect it from the air and will prevent flies from falling in. Formaldehyde, like any other stomach poison for flies, will be most effective under dry conditions."

Notes on the Ethiopian fruit flies of the family Trypaneidae, other than Dacus, III, M. Bezzi (*Bul. Ent. Research, 10 (1920), No. 3, pp. 211–272, pls. 2*).—This continuation of papers previously noted (E. S. R., 39, p. 467) includes a systematic catalogue of 216 species, represented by 54 genera. Nine genera are erected and 29 forms described as new.

Review of the Nearctic Tetanoceridae [Sciomyzidae], A. L. Melander (*Ann. Ent. Soc. Amer., 13 (1920), No. 3, pp. 305–332, pl. 1, fig. 1*).—The author here gives synoptic keys to 22 genera, 89 species, and 8 varieties, of which 19 species are described as new to science.

Observations on Psyllobora taedata LeConte, a coccinellid attacking mildews, W. M. Davidson (*Ent. News, 32 (1921), No. 3, pp. 83–89*).—This is a report of anatomical and biological studies of a species which is found in all stages associated with fungus infestations of the mildew type. It appears to be especially attracted to rose and apple powdery mildew (*Sphærotheca pannosa* and *Podosphæra oxyacanthæ*, respectively).

Protection of mesquite cordwood and posts from borers, F. C. Craighead and G. Hofer (*U. S. Dept. Agr., Farmers' Bul. 1197 (1921), pp. 12, figs. 17*).—At-

tention is called to the importance of mesquite in the southwestern United States, where it is used for many purposes, particularly for fuel and fence posts, and to the fact that certain borers completely destroy mesquite wood in a few months after it is cut, causing great loss and inconvenience. Insects responsible for the damage include roundheaded borers, powder-post beetles, and flat-headed beetles. In the vicinity of Tucson, Ariz., where the experiments were conducted, there is only one roundheaded borer of much economic importance, namely, *Cyllene antennatus* White, but this is the most destructive insect in mesquite. Three powder-post beetles were found, namely, *Apatides fortis* Lec., *Dendrobiella aspera* Lec., and *Xylobiops* sp., and a flat-headed borer, *Chrysobothris octocola* Lec. In Texas another roundheaded borer (*Cyllene crinicornis* Chev.) and several other species of powder-post beetles (*Xylobiops* spp.) are equally numerous. The characteristics of the insects and their work, seasonal activity, and conditions favorable and unfavorable for attack are discussed.

It is pointed out that by cutting fuel wood at certain seasons and turning the more valuable products in the sun, practically all insect damage can be prevented. "Except for immediate use mesquite cordwood should not be cut during the spring and summer months. Wood which is cut between the middle of October and the latter part of January and which is loosely ricked, so that it quickly dries, is usually but little injured. The safest period, however, is from the middle of October to the end of November. Wood should not be stored longer than one year, after which much damage is done by the large powder-post beetle."

Arsenic for grub-infested soils, J. F. ILLIGWORTH (*Jour. Econ. Ent., 14 (1921), No. 2, pp. 238, 239*).—The author, working in North Queensland, reports that white grubs (*Isodon puncticollis* Macl.) attacking cucumbers in gardens are destroyed by sprinkling crude white arsenic (arsenious acid) through the soil of the hills at the rate of about 80 lbs. per acre. The arsenic had no injurious effect upon the growing plants even when used in excessive quantities, i. e., 200 lbs. per acre.

The winter of 1918–19 and the activities of insects with special reference to the clover leaf weevil (Hypera punctata Fab.), G. W. HERRICK (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 101–107*).—The discussion here presented accompanies a brief summary of weather conditions from November to April, inclusive, as recorded at the weather station at Cornell University.

Some injurious South African weevils, G. A. K. MARSHALL (*Bul. Ent. Research, 10 (1920), No. 3, pp. 273–276, pl. 1*).—*Prototsrophus planatus* and *P. instabilis*, both recorded as injuring the foliage of young orange trees in the Transvaal; *P. noxius*, found feeding on young wheat in the Orange Free State; and *Eremnus horticola*, found feeding on dahlias and chrysanthemums in the Orange Free State, are described as new.

Ant guests from Fiji and the British Solomon Islands, W. M. MANN (*Ann. Ent. Soc. Amer., 13 (1920), No. 1, pp. 60–69, figs. 9*).

A new pristomerine from California (Hym., Ichneumonidae), H. L. VIERICK (*Ent. News, 32 (1921), No. 6, pp. 172–174*).

Notes on Hellén's Beiträge zur Kenntnis der Ichneumoniden Finlands: subfamilie Pimplinae, R. A. CUSHMAN and S. A. ROHWER (*Insecutor Inscitiae Menstruus, 8 (1920), No. 7–9, pp. 161–163*).

[Dusting vegetables for insect control], H. J. EUSTACE (*Michigan Sta. Rpt. 1919, pp. 282–284*).—The Niagara Contact Special Dusting Mixture, consisting of sulphur 49 per cent, nicotin 0.25 per cent, and inert ingredients 50.75 per cent, was applied to cucumbers and squashes for aphids, with an Ideal Power Duster.

The results lead to the conclusion that "aphids can be controlled by the dusting method when conditions are such that the dust can be brought in contact with them. This can be done with such crops as cucumbers or muskmelons, but not with rank-growing vine crops, such as squash, excepting during their earlier periods of development."

A mixture of dry calcium arsenate 15 per cent and talc 85 per cent, applied to potatoes with an Ideal Power Duster, destroyed all the potato beetle larvæ and appeared to act more quickly than where the arsenical was applied as a spray.

Spray now to kill European red mite, W. E. Britton (*Connecticut State Sta. Bul. Immed. Inform. 13 (1921), pp. 3*).—This relates to *Paratetranychus pilosus* C. and F., an account of which is given in the report previously noted (E. S. R., 45 p. 149). Laboratory tests with commercial insecticides for its control in the egg stage have shown that miscible oils like Scalecide are more effective than lime sulphur, nicotin solution, or any of the other preparations tested. It is recommended that, as a means of control, Scalecide or some other miscible oil, 1 part in 15 parts of water, be applied so thoroughly that every twig and portion of the bark is covered.

The genus Trombicula Berl. in America and the Orient, H. E. Ewing (*Ann. Ent. Soc. Amer., 13 (1920), No. 4, pp. 381–390, figs. 3*).—The author recognizes two species of Trombicula as occurring in the United States, namely, *T. splendens* Ew., described from Portage, Wis., in 1909, and *T. cinnabaris* n. sp., here described from East Falls Church, Va., and North Beach, Md.

A supplementary note to the biography of W. H. Patton, B. H. Ransom (*Ent. News, 32 (1921), No. 5, p. 154*).

FOODS—HUMAN NUTRITION.

Some observations of corn meal in storage, L. H. Bailey and C. Thom (*Oper. Miller, 25 (1920), No. 12, pp. 368–371, figs. 4*).—Experiments on the keeping qualities of corn in storage, begun by Winton et al. (E. S. R., 33, p. 259), have been continued at the Bureau of Chemistry, U. S. Department of Agriculture, to include studies of the keeping qualities of many grades of commercial corn meal under laboratory and commercial storage conditions. This paper reports a study of a commercially successful practice in which whole corn is milled with and without the removal of bran from the finished product.

For the experiment four lots of corn were selected and milled, half of each lot being bolted and the other half left with nothing removed from the whole corn. The percentages of moisture in the unbolted and bolted freshly milled products were, respectively, as follows: 16.62 and 16.22, 15.82 and 14.89, 13.98 and 14.17, and 12.86 and 12.5. Immediately after milling the meal was placed in cotton bags, 100 lbs. to the bag, and the bags were piled five deep on heavy paper on a cement floor in a well ventilated galvanized-iron building. The piles were arranged in two tiers, with plenty of room to walk around each tier, thus affording good circulation of air. Thermometers were placed in the centers of the bags at frequent intervals, and at no time did the temperature of the meal exceed 15° C. (59° F.). The samples were taken out each week during the period of storage from April until August, 1920, and were analyzed for moisture, acidity, and H-ion concentration.

The results of these analyses show a gradual decrease in moisture in all the samples to an approximately uniform content. The acidity increased with more or less regularity until about the middle of July. There was no evidence of heating, caking, or molding in any of the samples, and all were in a merchantable condition at the end of the experiment. The taste of the meal,

especially in the bolted samples, was slightly sharper than that of fresh meal, but muffins baked from typical samples had no objectionable taste.

Subsamples of the meal packed in sterilized pint fruit jars and stored in the laboratory for the same length of time showed a marked contrast on examination and analysis. Samples of the lowest initial moisture content showed no physical signs of deterioration or differences in acidity. With increase in initial moisture content there was progressive increase in acidity and mold development.

These results show that for this lot of corn there was a critical moisture percentage at or below 13. Below this spoilage takes place very slowly, if at all, while above it the spoilage is rapid unless the meal is kept under conditions of temperature and ventilation which will prevent the growth of microorganisms. This is effected largely by the loss in water of the meal on prolonged storage, which tends to bring it down below the critical moisture content.

Rice as food (*U. S. Dept. Agr., Farmers' Bul. 1195, pp. 22, figs. 4*).—Information regarding the food value of rice, rice milling, and rice cooking is brought together, and standardized recipes are given. A section on wild rice, known to the Indians since pre-Columbian times and now fairly common in some markets, is included.

Milling and baking tests [with wheats grown on the North Dakota College demonstration farms], E. I. Olsen (*North Dakota Sta. Bul. 148 (1921), pp. 33–35, figs. 7*).—Results are reported in tabular form on milling and baking tests with hard red spring wheat (Marquis and Power Fife) and durum wheat (Kubanka, Arnautka, and Acme). Considerable variation was noted in the bread made from the same variety of wheat grown on the different farms.

The decomposition of the proteins of different varieties of milk into the usual assimilable forms through pepsin-hydrochloric acid and pancreatin, and the effect of the addition of electrolytes and nonelectrolytes, A. Gabathuler (*Fermentforschung, 3 (1920), No. 2, pp. 81–192, figs. 50*).—This article is essentially a plea, based on original investigations and abundant references to the literature, for the use of raw instead of pasteurized or boiled milk on account of its more ready digestibility, and for such a system of milk control as will enable the placing on the market of milk of such quality with respect to kind and quantity of bacteria that it can be safely used raw.

The necessity of clear thinking in milk modification, L. W. Hill (*Jour. Amer. Med. Assoc., 76 (1921), No. 10, pp. 633–637*).—The author describes briefly the methods of modifying cow's milk for infant feeding by whole milk dilution, top milk dilution, and gravity cream and skimmed milk mixtures.

Use more cheese, L. Brewer (*Cornell Reading Course for the Home, No. 133 (1920), pp. 31, figs. 2*).—In addition to a discussion of the selection and use of cheese, this publication contains a large number of recipes.

The preservation of meats, M. L. Matthews (*Purdue Agr. Ext. Bul. 95 (1920), pp. 12*).—This publication includes a brief outline of methods commonly employed for the preservation of meat, special directions for curing pork and beef, miscellaneous recipes, and general directions for the smoking of meats and the preservation of smoked meats.

The effect of blanching in the canning of some typical crops of vegetables, E. Geldehaus (*Missouri Sta. Bul. 179 (1921), p. 37*).—A study of the rate of heating of quart cans of spinach under different conditions is briefly reported. It required 15 minutes longer to bring to the boiling point spinach blanched by the steam and cold-dip method than when simply wilted in the top of a double boiler and packed directly into the jar. Increasing the amount of

material in the jar from 1,000 to 1,500 gm. did not influence the time required for the center of the jar to reach the temperature of 100° C.

[Spoilage in canned corn], Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 240, 241*).—From a can of corn which had undergone a peculiar type of spoilage characterized by the development of no unpleasant odor or taste but a change in the appearance of the corn to a slimy consistency, the author has isolated an organism consisting of short rods in pairs or short chains.

"This bacillus is an example of the type of organisms very frequently found in spoiling canned foods, i. e., an organism difficult to isolate on account of its peculiar cultural requirements. This organism grows well on no medium used except corn agar and sterile corn and peas. This peculiarlity of certain organisms is very frequently the explanation why certain spoiled canned goods are declared sterile or the organisms isolated do not show gas production in ordinary media."

Standardization of cooking temperatures, L. STANLEY and N. COLLIER (*Missouri Sta. Bul. 179 (1921), pp. 37, 38*).—In a study of baking temperatures for cakes as affected by the amount of baking powder used, cakes made according to a standard recipe were baked at eight temperatures ranging from 175° to 225° C. According to the authors, the baking temperatures had no effect on the specific volume or texture when a medium amount of baking powder was used. When eight teaspoonfuls of baking powder were used the volume of the cakes was greater than when one teaspoonful was used, but the increase was not regular. At all the baking temperatures the specific volume of cakes was slightly larger when one cake was baked at a time than when four cakes were baked, probably because "the temperature inside the cake was higher in a shorter length of time where one cake was baked than where four were baked." No relation was noted between the amount of baking powder and the water loss in baking, and after standing 24 hours and 48 hours, or in total water loss; nor between water loss and baking temperature.

The time required for baking was decreased as the temperature for baking was increased. The kind of sugar used had little effect on the specific volume of the cake, but it did have a marked effect on the texture, the best results being obtained with powdered or fine grained sugar.

The specific volume was greater when the egg white was beaten separately. Whether egg white was added last or before the baking powder, no difference in specific volume was noted. The greater the amount of batter, the greater the specific volume of the cakes.

Dietitians in hotel, E. M. STATLER (*Hotel Mo., 29 (1921), No. 340, pp. 67, 68*).—An account is given of the successful employment of dietitians trained in home economics to deal with the problems of feeding hotel employees in a large hotel in New York City. The success of the work there led to the employment of dietitians for similar purposes in large hotels in other cities.

Cost accounting for the country hotel, S. O. CHADWICK (*Hotel Mo., 29 (1921), No. 336, pp. 28–30*).—A system of cost accounting suited for a business of moderate size is described.

Textbook of physiological chemistry.—II, Inorganic nutrients.—The significance of the physical state of cell and tissue constituents for their functions.—The ferments, their action and significance.—Hitherto unknown nutrients with specific action.—Problems of total and energy metabolism.—Metabolism of special organs and cells, E. ABDERHALDEN (*Lehrbuch der Physiologischen Chemie.—2. Teil, Die Anorganischen Nahrungsstoffe.—Die Bedeutung des Physikalischen Zustandes der Zell und Gewebsbestandteile für ihre Funktionen.—Die Fermente, ihr Wesen, ihre Wirkung, und ihre Bedeutung.—Bisher unbekannte Nahrungsstoffe mit Spezifischen Wirkungen.—Prob-*

leme des Gesamtstoff und Kraftwechsels.—Stoff und Kraftwechsel Einzelner Organe und Zellen. Berlin and Vienna: Urban & Schwarzenberg, 1921, vol. 2, 4, ed., rev., pp. VIII+723, figs. 38).—This is a revision of the third edition of part 2 of this textbook on physiological chemistry (E. S. R., 34, p. 563). The corresponding revision of part 1 has been previously noted (E. S. R., 44, p. 556).

An aspect of protein metabolism, D. N. Paton (*Brit. Assoc. Adv. Sci. Rpt., 87 (1919), pp. 294–307*).—This presidential lecture, delivered before the Physiology Section of the British Association for the Advancement of Science, deals principally with the question of the significance of creatin in protein metabolism. Evidence is presented from the literature and from hitherto unpublished results from the author's laboratory that the significant part of the creatin molecule is the guanidin nucleus, and that by the formation of creatin free guanidin resulting from the decomposition of the protein is detoxicated and rendered available for synthesis into muscle substance. A list of 32 literature references is appended.

Comparative metabolism of proteins of unlike composition, W. G. Karr (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 289–295*).—To determine whether the proportions of the end products of nitrogenous metabolism in the urine are altered by the type of distribution of nitrogen in the protein intake, metabolism experiments were conducted on dogs using diets varying only in the character of the protein. Casein was selected as an example of a protein with a low content and gluten with a high content of amid nitrogen. These were fed on a high and low protein intake, the remaining calorific requirement being supplied by equal weights of lard and sucrose, with a supplement of 2 gm. of NaCl and 5 gm. of bone ash. Additional experiments were also conducted using dried commercial brewery yeast as the sole source of nitrogen. Urinary analyses were made in the casein and gluten experiments and analyses of both urine and feces in the yeast experiments.

The urinary ammonia output was found not to be influenced to any appreciable extent by the character or quantity of the two proteins. The average excretion on the casein diets was 6.5 per cent and on the gluten diets 5.6 per cent of the total nitrogen. The slight increase on the casein diet is thought to be due to the greater potential acidity of the casein. The creatin found was apparently independent of the nature of the protein and the creatinin evidently of endogenous origin.

The ammonia output in the yeast experiments compared favorably with that of the casein and gluten, giving further evidence that it is not influenced by the character of the protein. The utilization of the yeast nitrogen was about 80 per cent.

Creatin and muscle tonus in man, F. S. Hammett (*Jour. Amer. Med. Assoc., 76 (1921), No. 8, pp. 502, 503*).—The author reports a series of analyses of blood from two individuals, first during catatonic stupor and later as the subjects emerged from this condition. In both subjects an absolute and relative increase in creatin occurred with the reestablishment of muscular tone, the increased creatin continuing for some time after the beginning of perceptible muscular movements. These results are thought to support the theory that creatin is an endpoint of the catabolism of that phase of muscle-protein catabolism associated with the condition of muscle tonus.

Gastric analysis.—I, II, M. E. Rehfuss and P. B. Hawk (*Jour. Amer. Med. Assoc., 76 (1921), Nos. 6, pp. 371–373; 9, pp. 564–566*).—Two papers are noted.

I. *Fundamental principles.*—The principal functions of gastric analysis are summarized as the determination of evacuation time or motor activity, the determination of secretory activity and work, and the detection of the presence of pathological products. Factors considered essential to a satisfactory under-

standing and interpretation of gastric analysis are an absolute conception of normal gastric work, including variations in evacuation and secretion, and of the normal sequence of digestive and interdigestive phases, and a proper standardization of test meals.

II. *The interdigestive phase or the principles governing the phenomena of the resting stomach.*—The authors discuss the characteristics of the normal interdigestive or rest period of gastric analysis on the basis of their previous findings on men (E. S. R., 34, p. 663) and those of Fowler and Zentmire on women (E. S. R., 36, p. 562), together with subsequent observations in the series of studies on gastric response to foods (E. S. R., 44, p. 665).

"The interdigestive period reveals three phenomena: The first motor, in which peristole and tonal and hunger contractions supplant peristalsis; the second, a lessening in secretory velocity and a reduction of the titratable acidity to less than half of that seen in the digestive phase; and the third, an alteration in the status of the stomach and duodenum during this period, which accounts for some of its characteristics.

"In health a satisfactory balance is maintained between the digestive and interdigestive periods. In disease, on the other hand, this balance is ruptured and altered and the interdigestive period may be completely obliterated—a condition comparable to incompetence in other organs of the body."

Some phases of the pathology of nutrition in infancy, W. McK. Marriott (*Amer. Jour. Diseases Children, 20 (1920), No. 6, pp. 461–485*).—In this paper, presented before the Harvey Society of New York on March 27, 1920, the author discusses two types of nutritional disturbances in children, one an acute toxic-like condition usually following severe diarrhea, and the other a chronic state of failing nutrition, known as marasmus. It is shown that the clinical picture in the first condition is due to lack of water and in the other to lack of nourishment. Nutritional methods for the restoration of normal processes in both conditions are discussed.

A study of the urine sugar in infants, R. M. Greenthal (*Amer. Jour. Diseases Children, 20 (1920), No 6, pp. 556–561*).—A series of 170 urinary sugar determinations upon 37 infants, normal in the sense of being free from infections or gastroenteric disturbances, is reported. The determinations were made upon 8-hour collections of urine, using the method of Benedict and Osterberg (E. S. R., 39, p. 112) with slight modifications. Both total and nonfermentable sugars were determined, and the fermentable sugars were calculated by difference. Qualitative tests by Benedict's reagent were made on each sample.

The urine in all cases was found to contain a determinable amount of reducing sugar, which was not dependent upon the volume of urine, but was directly proportional to the amount of sugar ingested, the increase being distinctly in the fermentable portion. On a constant sugar intake the excretion of both fermentable and nonfermentable sugars was fairly constant. The extreme variations in total sugar excretion calculated to a 24-hour basis were 100 and 815 mg., the nonfermentable varying from 45 to 253 mg. Considering only the amount of urinary sugar in infants receiving from 6 to 7.5 mg. of sugar, the values for total sugar ranged from 100 to 400 mg. and for the nonfermentable portions from 45 to 150 mg.

It is pointed out that the results obtained in this study in general confirm those of Benedict et al. on the urinary sugar of adults (E. S. R., 39, p. 874), but are in contradiction to the conclusions of Porter and Dunn (E. S. R., 34, p. 258) that there is no direct relationship between the amount of sugar ingested by infants and the presence of sugar in the urine. This discrepancy is thought to be due to the fact that the above authors used qualitative tests only.

The so-called vitamins, B. NEPPI (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 10, pp. 573–580*).—This is a brief and comprehensive discussion of some of the important work on vitamins.

Economy in feeding the family: Why we must have vegetables, E. H. JENKINS (*Connecticut State Sta. Bul. Inform., 11 (1920), pp. 3*).—In this discussion of the importance of vegetables in the diet, special attention is paid to vitamins.

The effect of yeast on the utilization of food by white mice, R. R. RENSHAW (*Amer. Nat., 55 (1921), No. 636, pp. 73–78*).—In order to eliminate the question of variability of individual animals from the point of view of efficiency as energy transformers in vitamin studies, the author suggests feeding a number of animals a basal diet plus such an amount of vitamin-containing material as to keep the animal in weight equilibrium over a period of time. When this weight equilibruium has been maintained for a number of days and the food consumption noted, the same daily ration should be fed with the exception of a larger vitamin content and the weight noted at the end of the same period of time.

Data from a preliminary experiment conducted on mice according to this scheme are reported. These show that mice which have been brought to approximate weight equilibrium on a diet of casein, starch, lard, butter, salts, and 1 per cent of yeast gain appreciably in weight when kept for approximately the same time on the same ration with 3 or 5 per cent of yeast, the starch and casein being changed to maintain the same calorific value.

A critique of experiments with diets free from fat-soluble vitamin, T. B. OSBORNE and L. B. MENDEL (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 277–288, figs. 5*).—Attention is called to the conflicting results obtained by various investigators as to the effect on young rats of diets supposedly free from vitamin A. In some cases growth continues at a nearly normal rate for periods from 60 to 80 days, while in others no growth is obtained under apparently identical conditions. The conflicting results obtained in the use of lard as the only source of vitamin A are also quoted as illustrative of the general discrepancy of results and as suggestive of the possibility that these discrepancies may be due to failure to completely remove vitamin A from the basal ration.

New data are reported on experiments in which the protein (casein or edestin), the corn starch, and the previously dried brewery yeast used in the basal ration were boiled three successive times with absolute alcohol under a reflux condenser and then filtered off by suction. The diets consisted of extracted protein 18, starch 48, salt mixture 4, and lard 30 per cent, with 0.4 gm. of extracted yeast administered daily apart from this ration.

The growth curves of young rats on this ration as compared with those of animals on the same ration of unextracted materials showed that this treatment caused a reduction of the period of undiminished growth, although in all cases there was limited growth for some time. This is thought to indicate that the extraction may have removed from the food a small amount of vitamin A or other substances which may be of importance for the well-being of the animal.

The authors are of the opinion that, unless the ability of the animals to grow in the supposed absence of vitamin A is due to exceptional vitality of the individuals or to reserve stores of the vitamin in the body, "it seems necessary to conclude, in the light of our experience, that removal of fat-soluble vitamin from even purified proteins and carbohydrates is accomplished with far greater difficulty than has been hitherto suspected."

The effect of certain dietary deficiencies on the suprarenal glands, C. H. KELLEWAY (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 642, pp. 6–27, pl.*

1, fig. 1).—The studies reported in this paper consist essentially in an investigation of various points brought out in the observations of McCarrison on the enlargement of the adrenal glands with increase in their content of adrenalin in pigeons suffering from polyneuritis on a polished rice diet (E. S. R., 44, p. 262).

Preliminary observations on normal pigeons which had been kept caged for varying periods showed a progressive increase in the weight of adrenalin per kilogram of body weight with prolonged captivity. While it has not been proved how far this was due to lack of exercise and how far to seasonal variation, the data are thought to indicate the necessity of using as controls, in any study of the effect of diet on the adrenals, birds kept on normal diet for the same period under identical conditions.

The experimental data reported include observations on pigeons fed with polished rice alone and with the addition of Marmite, olive oil, cod liver oil, and casein extracted with ether and absolute alcohol, the weight of adrenals and content of adrenalin being compared in each case with that of normal birds kept under the same conditions. These data confirm McCarrison's observations on the occurrence of enlargement of the adrenals with increased store of adrenalin in pigeons fed on polished rice, and show the same to be true of those fed on polished rice plus either protein or fat. The changes were prevented by the addition of an adequate ration of yeast extract. The addition of yeast extract to a basic diet of polished rice with extra fat or protein did not prevent an increase in the store of adrenalin but did prevent the enlargement of the glands.

In an effort to explain the enlargement of the adrenals, the theory that it was the result of inanition and due to the storage in the adrenal cortex of lipoids which had been set free by the breaking down of body tissues was tested by determinations of the cholesterol content of the adrenals and blood of polyneuritic pigeons and of pigeons and rabbits fed on a normal diet with the addition of cholesterol. In pigeons with extreme symptoms of polyneuritis an increase in the percentage of cholesterol in the blood was noted, but no evidence of storage in the adrenals. The production of hypercholesteremia in normal rabbits and pigeons resulted in a small increase in the content of adrenalin in the adrenals.

"The increased content of adrenalin in the adrenals of birds on deficient diets is attributed to diminished output of adrenalin as a result of lowered body metabolism. The edema which occurs in some cases of experimental polyneuritis is not due to increased output of adrenalin. Daily administration of adrenalin to birds fed on normal or polished rice does not cause edema, nor does it accelerate or retard the onset of polyneuritis in pigeons on a polished rice diet."

Report on an outbreak of pellagra amongst Armenian refugees, 1916–17 [Food in relation to pellagra], R. G. White (*Egypt Dept. Pub. Health, Rpts. and Notes Pub. Health Labs., No. 2 (1919), pp. 46, pls. 11, fig. 1*).—The history of the refugees and of the outbreak is given, as well as information on the nature of food and employment, and also details regarding the clinical, experimental, and bacteriological examinations which were made.

The weight of evidence, according to the author, points directly to a faulty diet as a causal factor in the outbreak. Pellagra was eradicated from the camp by correcting the faulty dietary, all other conditions remaining the same. The consumption of maize may have been a factor in the causation of the outbreak, but only as far as it may have been responsible for some deficiency in the diet. "It certainly had no direct causal relation to the disease."

Scurvy: Past and present, A. F. HESS (*Philadelphia and London: J. B. Lippincott Co., 1920, pp. VII+279, pls. 11, figs. 12; rev. in Brit. Med. Jour., No. 3133 (1921), p. 85*).—In this volume, said to be the first treatise on scurvy which has been published in English since the work of Lind in 1772, the author has brought together the recent advances in the knowledge of this nutritional disease, both from the experimental and clinical standpoint. A brief history of the disease, including its occurrence in the various armies and in the civilian populations during the recent war, is followed by chapters on pathogenesis and etiology, the antiscorbutic vitamin, gross and microscopic pathology, experimental scurvy, antiscorbutic foods, symptomatology and diagnosis, prognosis, treatment, metabolism, and the relation of scurvy to other diseases.

The book is illustrated by various charts, micrographs, and radiographs, and an extensive bibliography is appended.

ANIMAL PRODUCTION.

Nitrogen and other losses during the ensiling of corn, R. H. SHAW, P. A. WRIGHT, and E. F. DEYSHER (*U. S. Dept. Agr. Bul. 953 (1921), pp. 16*).—The authors report data on the composition and nitrogen distribution during two seasons of samples of corn silage taken from bags buried at different levels in a cylindrical concrete silo at the Dairy Division farm at Beltsville, Md.

There was in general a perceptible loss of nitrogen from the bags, due mainly to the escape of albuminoid nitrogen in the juice. There was also a considerable decrease in the crude fiber and in the furfural-yielding bodies, while the reducing and nonreducing sugars almost entirely disappeared. It is estimated that the loss of nitrogen in the 2,579 lbs. of juice collected during the first year represented the protein in about 1,500 lbs. of average silage, while in the second year, when the amount of juice (9,494.5 lbs.) was much greater, due to the relative immaturity of the corn, the loss was equivalent to the protein in 7,500 lbs. of silage.

There is a bibliography of 19 titles.

Analysis of Russian thistle hay (*North Dakota Sta. Bul. 146 (1921), p. 5*).—Russian thistle hay was found to have the following percentage composition: Moisture 6.5, crude protein 12.5, ether extract 3.3, crude fiber 22.3, nitrogen-free extract 39.9, and ash 15.5. A mineral analysis is also given. The cathartic properties of the hay are attributed to potassium chlorid.

Commercial feeding stuffs, E. G. PROULX ET AL. (*Indiana Sta. Bul. 252 (1921), pp. 15*).—This bulletin consists of suggestions for users of commercial feeding stuffs, tabulated average analyses, notes on the consumption of various classes of feeds in Indiana, and statements of some of the provisions of the State Feeding Stuffs Control Law.

A study of the distribution of iodin between cells and colloid in the thyroid gland.—I, Methods and results of study of beef, sheep, and pig thyroid glands, A. L. TATUM (*Jour. Biol. Chem., 42 (1920), No. 1, pp. 47–53*).—Colloid-free thyroid tissue was secured by washing frozen sections of the fresh gland in Ringer's solution, sections being cut sufficiently thin to open all acini. The cell mass contained appreciable amounts of iodin but the percentage varied considerably, although the ratio of this percentage to the percentage in the whole gland is considered fairly constant. Two pig, 9 sheep, and 18 ox thyroids were used in the investigation.

Effect of feeding the pineal body upon the development of the albino rat, W. R. SISSON and J. M. T. FINNEY (*Jour. Expt. Med., 21 (1920), No. 3, pp. 335–346 pl. 1 figs. 5*).—Experiments are reported which show that the feeding of desiccated pineal body of young calves was without effect upon the development

of young albino rats, being without influence on the body dimensions and weights of the thymus and testes.

Initiative in evolution, W. A. KIDD (*London: H. F. & G. Witherby, 1920, pp. X+262, figs. 80*).—The author assembles as evidence in favor of his well-known theory of use-inheritance a variety of information as to the distribution and direction of the hair on the bodies of domestic animals and man, and reports observations on the influence of harness on the hair of horses.

Fat cattle prices and pure-bred values, E. N. WENTWORTH (*Breeder's Gaz., 79 (1921), No. 21, p. 947, fig. 1*).—The author has studied the sales records of pure-bred Shorthorn, Hereford, and Aberdeen-Angus cattle during the years 1900 to 1920. The prices received averaged about three times the current values of native steers of comparable quality sold on the Chicago market. From 1900 to 1903 and from 1916 to 1920 the pure-bred cattle were relatively more valuable, but during the intermediate period they were less valuable.

Live stock investigations for the year 1920–21, C. W. MCCAMPBELL (*Kansas Sta., Fort Hays Substa. [Pamphlet], 1921, pp. 3–8*).—This publication was designed for distribution during the cattlemen's "round-up" at the Fort Hays Substation in April, 1921, and reports experiments with cattle and sheep designed particularly to show the value of wheat straw in the winter ration.

In a 120-day experiment with 6 lots of 10 mature cows just off the range with suckling calves at side, the lot fed wheat straw exclusively (25.5 lbs. per head daily) lost on an average of 0.02 lb. per cow per day, while the lot fed sorghum silage exclusively (42.5 lbs. per head daily) lost 0.23 lb. The replacement of 12.5 lbs. of silage by 2 lbs. of cottonseed cake produced a gain of 0.013 lb. The addition of 2 lbs. of cottonseed cake to the straw ration caused a daily gain of 0.5 lb. The combination of 20 lbs. of straw and 30 lbs. of silage produced a daily gain of 0.37 lb., while 15 lbs. of straw, 30 lbs. of silage, and 2 lbs. of cottonseed cake produced a gain of 1.08 lbs.

In a 120-day experiment with 2 lots of 20 375-lb. steers each, it was found that a ration of 11.73 lbs. of wheat straw and 1 lb. of cottonseed cake produced a daily gain of 0.58 lb., while a ration of 21.25 lbs. of sorghum silage and 1 lb. of cottonseed cake produced a daily gain of 0.5 lb. The gains of these lots during the summer and the following winter will be reported later.

In a 100-day test with 59 70-lb. lambs divided into 2 lots, it was found that a ration of 2 lbs. of sorghum silage, 0.66 lb. of wheat straw, and 0.125 lb. of cottonseed meal resulted in a loss in weight averaging 0.052 lb. per head daily. When 0.25 lb. of ground kafir was added to essentially the same ration there was a slight gain, averaging 0.035 lb. Neither ration is considered satisfactory.

In a 100-day test with 175 mature ewes divided into 2 groups, it was found that a ration composed of wheat straw and cottonseed meal, the latter replaced by ground kafir and bran during the last 40 days, resulted in a loss in weight, but the addition of cane silage to such a ration produced a slight gain. These sheep showed decided lack of thriftiness which disappeared when cottonseed meal was dropped from the ration and replaced by kafir and bran. A similar improvement was noted, however, in a subgroup of the silage-fed lot in which kafir and bran were fed in conjunction with cottonseed meal.

Use of feed experiments, C. R. MOULTON, W. S. RITCHIE, and L. D. HAIGH (*Missouri Sta. Bul. 179 (1921), pp. 11–13, figs. 4*).—Charts are presented showing the growth in weight, height, girth, and length that may be expected of beef animals from birth to four years of age when fed full, medium, and poor rations, respectively.

[Cattle feeding experiments at the North Dakota Station] (*North Dakota Sta. Bul. 146 (1921), pp. 20, 21, 28–34*).—A continuation of the grazing and nutrition experiments noted from Bulletin 136 (E. S. R., 43, p. 374) is reported.

In the fourth year (1919) of the pasture test of native range grasses, steers given 3 acres per head exhausted the pasture in 90 days, while steers given 5, 7, or 10 acres per head were carried throughout the season of 140 days. The average of the 4 years shows that the maximum gains per steer were secured with 7 acres to a steer and the maximum gains per acre with 3 to the steer.

In two repetitions of the comparison between high and low protein rations of equal energy, one made with 700-lb. yearling steers and the other with calves, no marked or consistent differences in gains or economy of gain were observed betwen the groups fed the two rations.

The cut-over pine lands of the South for beef-cattle production, F. W. FARLEY and S. W. GREENE (*U. S. Dept. Agr. Bul. 827 (1921), pp. 51, figs. 13*).—This is a survey of the cattle industry in the Coastal Plain region of the southeastern part of the United States, and the possibilities of the cut-over lands for beef production. Discussions of climate, soils, land ownership, pastures, feeding of cattle, buildings and shelter, diseases, water supply, and markets are included.

The improvement of the native pastures is considered the most important problem facing the beef producer in this region, and it is recommended that the main emphasis be placed upon the spread and protection of carpet grass and lespedeza. For winter feeding corn stover, legume hays, cottonseed hulls, and corn silage are the principal roughages recommended, while for concentrates the main reliance is placed upon velvet beans.

A brief report is made of a feeding experiment conducted in collaboration with the Mississippi Experiment Station showing that essentially the same gains and economy of gain were secured whether the velvet beans and pods were crushed or not. The steers, however, seemed to relish the whole beans better than the crushed beans.

Heavy and light grain rations when fed in connection with corn silage and clover hay for fattening steers, E. A. TROWBRIDGE (*Missouri Sta. Bul. 179 (1921), pp. 15, 16, fig. 1*).—Results of a 120-day feeding experiment with 5 lots of 8 900-lb. steers are tabulated. The standard ration consisted of corn, linseed cake, alfalfa hay, and corn silage and resulted in a daily gain of 2.85 lbs. per head. When this was modified by feeding the corn during the last 60 days only, the daily gain was 2.39 lbs. The gain was 2.14 lbs. when no concentrates were fed during the first 60 days, 2.12 lbs. when corn was entirely omitted but with cake fed throughout, and 1.99 lbs. when the corn was omitted and the cake fed during the last 60 days only.

Barley v. corn for fattening steers (*Wisconsin Sta. Bul. 323 (1920), pp. 12, 13*).—In an experiment by J. G. Fuller, F. B. Morrison, and J. M. Fargo a lot of 10 steers fed crushed barley, cottonseed meal, corn silage, and mixed hay for 126 days gained 2.45 lbs. per head daily, while a similar lot fed shelled corn in place of barley and an increased proportion of cottonseed meal gained 2.03 lbs. The barley lot shrank more in shipment but sold for 15 cts. more per 100 lbs. "Considering all the factors, crushed barley in this trial was worth fully as much per ton as shelled corn for beef production."

Nutrition of heifers—raising calves on milk substitutes, A. C. RAGSDALE and C. W. TURNER (*Missouri Sta. Bul. 179 (1921), p. 22*).—Two lots of calves were taken off skim milk at the age of 60 days. The lot fed soy bean hay and a mixture of corn chop, bran, and linseed meal (4:1:1) made 71 per cent of the normal gains in weight and 70 per cent of the normal gains in height. The lot fed alfalfa hay and a similar grain mixture in which soy bean replaced linseed meal made less than 40 per cent of the normal gains in weight and 45

per cent of the normal gains in height. The differences are attributed largely to the fact that the second lot would not eat large quantities of the hay.

Sunflower silage for sheep, H. HACKEDORN (*Washington Sta. Bul. 158 (1920), pp. 11, 12*).—From a study of the composition of sunflower silage and its digestibility by sheep, it was found that 100 lbs. of the silage contained 1.72 lbs. crude protein, 1.76 lbs. ether extract, 6.42 lbs. crude fiber, and 9.96 lbs. nitrogen-free extract, of which 1, 1.45, 2.5, and 5.67 lbs., respectively, were digested.

Two lots of 5 lambs each were fed barley, cull beans, pea straw, and corn or sunflower silage. The lot fed corn silage required 4.4 lbs. of grain, 1.9 lbs. of pea straw, and 5.3 lbs. of silage per pound of gain, while the lot fed sunflower silage required 6.7 lbs. of grain, 3.1 lbs. of straw, and 8.1 lbs. of silage. The length of the feeding period is not stated.

Utilization experiments with poppy seed cake and walnut cake, F. HONCAMP, H. ZIMMERMANN, and E. BLANCK (*Landw. Vers. Sta., 93 (1919), No. 1–2, pp. 77–90, pls. 2*).—Digestion trials are reported in which oil cake from two varieties of poppy seed and decorticated and undecorticated walnut cake were fed to two sheep during 10-day periods in conjunction with meadow hay. The composition of the cakes and the average of the digestion coefficients for the two sheep follow:

Composition and digestibility of poppy seed cake and walnut cake.

Kind of oil cake fed.	Composition (dry basis).					Digestibility (sheep).				
	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.
Poppy seed:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Brown	35.14	5.80	15.43	27.52	16.11	68.6	81.6	99.5	40.9	60.3
White	44.40	8.10	10.18	27.09	10.23	85.8	90.9	89.1	91.0	72.0
Walnut:										
Undecorticated	23.22	8.96	30.90	31.95	4.97	53.5	83.8	97.5	14.5	58.9
Decorticated	45.81	9.55	6.76	32.12	5.76	88.8	91.2	97.9	36.9	94.7

The brown poppy seed cake was made from a crop raised in Asia Minor and the white cake came from East India poppies.

[Lamb feeding experiments at the Wisconsin Station] (*Wisconsin Sta. Bul. 323 (1920), pp. 13, 15*).—In three trials by F. B. Morrison and F. Kleinheinz lambs fed in a well ventilated barn averaged a daily gain of 0.395 lb. per head, while lambs in an open shed partially boarded up averaged 0.386 lb. The latter lambs required 2.5 per cent more concentrates, 10.8 per cent more hay, and 1.9 per cent more silage per unit gain.

In other experiments it was found that cottonseed meal is fully equal in value to linseed meal for fattening lambs. Gluten feed, when fed in large enough amounts to balance the ration, produced as rapid gains as linseed meal but not as high a finish.

Beet by-products for fattening lambs, E. J. MAYNARD (*Colorado Sta. Bul. 266 (1921), pp. 12, figs. 4*).—This is a report of a 93-day feeding trial, begun November 28, 1920, and involving 8 lots of 32 lambs each. The following table summarizes the methods of feeding and the main results.

Use of beet molasses and molasses beet pulp in a 93-day lamb feeding test.

Lot.	Beet product fed.	Grain fed.	Initial weight per lamb.	Daily ration.			Daily gain per lamb.	Feed per pound of gain.			Dressed weight.
				Beet product.	Grain.	Alfalfa hay.		Beet product.	Grain.	Alfalfa hay.	
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*
1	None	Corn	70.7	.....	1.03	2.50	0.334	.....	3.09	7.49	50.6
2	Molasses	do	71.0	0.30	.76	2.53	.347	0.86	2.20	7.26	50.4
3	do	Barley	71.1	.30	.76	2.54	.314	.95	2.43	8.08	49.7
4	do	Oats	71.1	.30	.76	2.61	.323	.92	2.36	8.09	49.0
5	Dried pulp	None	71.2	1.03	.....	2.45	.314	3.28	.....	7.81	49.0
6	do	Corn	70.8	.52	.52	2.50	.351	1.48	1.47	7.12	51.3
7	do	do	70.9	.34	.69	2.67	.338	1.02	2.04	7.91	50.5
8	Wet pulp	do	71.3	5.56	.52	2.17	.367	15.14	1.41	5.92	51.8

It is stated that beet molasses formed 25 per cent of the dry matter in the molasses beet pulp. The wet pulp had an average moisture content of 88 per cent, the dry pulp 11.4 per cent. Proximate analyses, made by E. L. Scott, of the feeds offered are tabulated.

Lot 1 showed the least shrinkage and lot 5 the greatest. The feeding of the dried beet pulp did not increase the labor cost over the straight grain ration. Molasses feeding increased the labor cost slightly, while the use of wet pulp more than doubled it.

Variation in farrow, with special reference to the birth weight of pigs, W. J. Carmichael and J. B. Rice (*Illinois Sta. Bul. 226, abs. (1920), p. 4*).—The complete bulletin has been noted (E. S. R., 43, p. 571).

Growing hogs in Georgia, R. M. Gridley and P. Tabor (*Ga. Col. Agr. Bul. 223 (1920), pp. 36, figs. 16*).—This general discussion includes information concerning hog pastures in the southern part of the United States.

Study of comparative value of protein supplements in swine rations, H. Hackedorn (*Washington Sta. Bul. 158 (1920), pp. 12, 13*).—In an experiment with 45-lb. pigs, 4 lots were fed barley and shorts (3:1) and a protein supplement until they reached a market weight of 225 or 250 lbs. The nutritive ratios were widened as the experiment progressed but were kept uniform from ration to ration. The supplements fed and the amounts of feed required per pound of gain were as follows: Linseed meal, 3.34 lbs.; fish meal, 3.39 lbs.; tankage, 4.03 lbs.; and coconut meal, 4.4 lbs. The coconut meal ration was found to be too bulky with the high proportion of coconut meal used.

In a grazing experiment in which hogs on pasture were compared with others in the dry lot, it was found that an acre of alfalfa pasture in 44 days saved 877 lbs. of grain and an acre of pea forage in 60 days saved 680 lbs. of grain. In a hogging-off experiment 15 94-lb. pigs, on an acre of corn yielding 36.7 bu. per acre, produced 487.5 lbs. of pork in 30 days.

[Hog feeding tests at the Edgeley Substation], O. A. Thompson (*North Dakota Sta. Bul. 145 (1921), pp. 24–26*).—Data collected during three years are tabulated, showing the gains of a group of hogs which were turned on to Canada field peas in August and then allowed to hog-off a field of white flint corn. A brief test in feeding pigs with ground barley in a self-feeder is also noted.

[Hog feeding experiments at the Wisconsin Station] (*Wisconsin Sta. Bul. 323 (1920), pp. 8–12, figs. 2*).—Continuation of experiments with whey as a supplement to grain in hog feeding (E. S. R., 44, p. 268) is reported. Younger pigs were employed in the new experiments, which were conducted by F. B. Morrison, G. Bohstedt, and J. M. Fargo, and it was found that whey did not provide

enough protein for maximum growth when fed alone with barley or corn, but that a small amount of tankage or linseed meal corrected this deficiency. Experiments also showed that middlings and linseed meal are satisfactory protein supplements to corn or barley only when the hogs have access to pasture. In the dry lot the addition of skim milk or tankage to such a ration greatly increased the rapidity and economy of gain. A mixture of linseed meal and tankage was found more satisfactory than tankage alone as a supplement to corn, both on pasture and in the dry lot.

Experiments were made by Morrison and Bohstedt to test the practical importance of Steenbock's discovery (E. S. R., 42, p. 461) that vitamin A tends to be associated with yellow pigment. Pigs fed yellow corn and tankage gained 1.59 lbs. per head daily, while pigs fed white corn and tankage gained only 1.13 lbs. and required 16 per cent more feed per unit gain. Orange-colored carrots added to a ration of white corn, linseed meal, and ground rock phosphate increased the gain, but sugar beets, which are known to be low in vitamin A, did not improve such a ration. There were no differences between yellow and white corn when there were other sources of vitamin A such as rape pasture or legume hay. Because of deficiencies not connected with vitamin content a ration of yellow corn and linseed meal was not satisfactory in the dry lot even when the lime content was increased by the addition of rock phosphate.

Some notes on perennial and annual pasture crops are included. Biennial sweet clover in a 2-year test proved inferior to alfalfa and to red clover.

Forages for swine, W. L. Robison (*Ohio Sta. Mo. Bul., 6 (1921), No. 3–4, pp. 46–50, fig. 1*).—This article consists mainly of excerpts from the section of Ohio Station Bulletin 343 (E. S. R., 44, p. 471) dealing with the comparison of forage crops. In particular experiments 14, 15, and 17 of the bulletin are reviewed.

Hogging down corn and soy beans, L. A. Weaver (*Missouri Sta. Bul. 179 (1921), pp. 16, 17*).—In a study of hogging down a field of corn in which soy beans had been sown at the final cultivation, it was found that the soy beans did not entirely take the place of a protein supplement (tankage).

Feeding trials with debittered lupines for fattening hogs, Müller (*Mitt. Ver. Deut. Schweinzüchter, 28 (1921), No. 4, pp. 73–77*).—A lot of 8 hogs fed a ration of debittered lupines, potatoes, and mangels (3:16:16) made an average daily gain of 0.62 kg. per head during the 8 weeks of the test. Two other lots fed rations containing, respectively, 50 and 100 per cent more lupines made less gain but consumed less feed. The gains tended to be proportional to the total feed consumption and not to the lupine content of the ration.

[Field peas for hogs at the Idaho Station] (*Idaho Sta. Bul. 122 (1921), pp. 26, 27*).—In a hogging off test during the summer of 1920, 6 fall pigs weighing 1,091 lbs. were turned on an acre of field peas having an estimated yield of 22 bu. per acre. They received a 1 per cent barley ration and in 35 days gained 344 lbs. A lot of 8 pigs weighing 1,656 lbs. and receiving a 2 per cent barley ration while on an acre of peas yielding about 20 bu. per acre gained 500 lbs. In the same period a lot of 13 spring pigs were kept on a 2-acre plat of peas, but received no grain ration. The initial weight per acre was 751.5 lbs. and the gain per acre 245.5 lbs.

In 2 experiments with rolled barley and cracked peas for fattening 150-lb. hogs, it was found that a 3:1 mixture produced more rapid and more economical gains than a 1:1 mixture and was definitely superior to a 1:3 mixture. The addition of tankage to the extent of 5 per cent of the grain mixture improved the gains in each case.

Soft pork studies, II, J. M. Scott (*Florida Sta. Bul. 160 (1921), p. 45–52, fig. 1*).—This is a report of a more extensive trial than that noted from Bulletin

157 (E. S. R., 43, p. 775) of the author's puncture method of studying the melting point of the fat of hogs during the progress of a feeding experiment.

Beginning August 23, 1920, 2 lots of Berkshires (6 sows and 4 barrows to a lot) were fed during two 44-day periods. The pigs had been raised on the station farm and had been fed uniformly on a light ration of corn and shorts, with access to Bermuda-grass pasture. The initial melting points of the fat ranged from 27.9 to 32.8° C. in lot 1 and from 26.6 to 33.1° in lot 2.

In the first period the lot 1 pigs were fed peanuts exclusively. By the end of the period the melting point of the fat of 9 individuals had declined, the decrease varying from 2.4 to 7.2°. The hog with the lowest initial melting point showed an increase of 0.5°. During the second period these hogs were fed corn, shorts, and cottonseed meal (4:5:1). For all of the 8 hogs of which there were records there was an increase in the melting point varying from 0.7 to 8.5°.

Lot 2 were fed corn, shorts, and cottonseed meal during the first period. In the case of 8 pigs there was an increase in the melting point ranging from 0.9 to 4.5°. The two animals with the highest initial melting points showed a decrease of 0.6 and 1.3°, respectively. During the second period lot 2 were fed peanuts alone. In 5 cases the melting point declined and in 5 cases it increased over the first period. The greatest decrease was shown by the pig with the highest melting point at the end of period one, and the greatest increases were shown by the 2 pigs having the lowest melting point at that time.

The change in the fat of peanut-fed rabbits, S. T. Dowell (*Science, n. ser., 53 (1921), No. 1377, p. 487*).—In connection with the soft pork investigations at the Oklahoma Experiment Station, 4 rabbits were fed peanuts and alfalfa for 6 weeks. One was killed at the end of the feeding period and the others after a fast of 3, 5, and 7 days, respectively. It was found that starvation caused a progressive decrease in the iodin number of the back fat (from 96 to 66) and the kidney fat (from 98 to 92), but the liver fat, which increased in amount as was expected, did not change its iodin number. It is concluded that the animals utilized the softer fats for body maintenance during fasting.

[Horse feeding results at the Missouri Station], E. A. Trowbridge and D. W. Chittenden (*Missouri Sta. Bul. 179 (1921), pp. 17, 18, figs. 2*).—Seven Percheron foals made an average daily gain of 1.51 lbs. per head from September 26, 1919, until they were put on pasture May 1, 1920. The ration averaged 6.75 lbs. of a grain mixture (oats, corn, and bran, 2:2:1) and 7.47 lbs. of choice alfalfa hay.

During 6 weeks in January and February, 1920, 6 mares not working were fed 15 lbs. of silage per head daily which they ate readily. The silage was fed in the evening, oat straw being given in the morning. The grain ration averaged 9.5 lbs. and the mares gained 15 lbs. per head during the feeding period.

Poultry as an economical producer of food, A. R. Lee (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 7 (1921), No 4, pp. 31, 32*).—At the Beltsville, Md., Experiment Farm of the U. S. Department of Agriculture Leghorn pullets consumed 4.8 lbs. of feed per dozen eggs and Leghorn yearlings 5.5 lbs. General purpose fowls as pullets consumed 6.7 lbs. and as yearlings 9.6 lbs. Extensive data on the cost of fattening chickens secured from commercial concerns by the Bureau of Animal Industry showed that 3.26 lbs. of grain and about 1.5 times this amount of buttermilk were required per pound of gain.

These results are compared with published data on the feed consumption per productive unit of other classes of live stock, and are held to show that poultry outrank steers and sheep in their ability to convert farm crops into human food.

[Poultry feeding at the Missouri Station], H. L. Kempster (*Missouri Sta. Bul. 179 (1921), pp. 43, 44*).—Studies on protein supplements (E. S. R., 43, p.

776) have been continued. In the pens receiving meat scrap, it is stated, the egg production was proportional to the amounts fed. As in earlier experiments, cottonseed meal proved distinctly inferior to meat scrap for egg production.

Eight lots of White Leghorn chicks were used in a study of the influence of supplementary feeds on growth. The greatest growth and lowest mortality during the first six weeks occurred in the pen fed both skim milk and egg yolk. The least growth and highest mortality occurred in the pens fed either white of eggs and bone meal or tankage and green food. Intermediate growth occurred when either whole milk, skim milk, whole eggs, or skim milk and green feed were given.

It is stated that second-generation chicks are being raised in the experiments in which chickens are being fed materials free from plant carotinoids (E. S. R., 44, p. 69). The chicks at the age of 12 weeks were normal except for the absence of the yellow pigmentation. The growth is described as excellent and the mortality was very low.

Cost of raising Leghorn chicks (*Idaho Sta. Bul. 122 (1921), p. 46*).—Data are presented showing the amount of fuel, feed, and labor required to raise 250 Leghorn chicks to the age of 12 weeks and 118 pullets from the twelfth to the twenty-fourth week.

Some problems of fox farming, J. A. Allen (*Sci. Agr., 1 (1921), No. 4, pp. 159–162, figs. 4*).—The author presents brief notes on the management of foxes, with particular reference to sanitation, feeding, breeding, registration, and the standardization of type. The article is based upon the experiences of the Fox Research Station, Charlottetown, P. E. I.

DAIRY FARMING—DAIRYING.

Comparison of feeding standards for dairy cows (*Wisconsin Sta. Bul. 323 (1920), pp. 7, 8, fig. 1*).—An experiment involving 16 cows divided into 2 groups and fed by the double reversal method during three 5-week periods was conducted by F. B. Morrison, G. C. Humphrey, and F. L. Putney for the purpose of comparing a ration balanced according to the Savage standard with one made up by the Armsby standard, the proportion of digestible protein in each case being the same. During feeding by the Armsby standard an average ration of 7.21 lbs. of concentrates, 10.8 lbs. of alfalfa hay, and 31.6 lbs. of corn silage was fed and the daily yield averaged 25.72 lbs. of milk and 0.97 lb. of butter fat. The Savage standard called for an increase in the concentrates and silage to 10.33 and 32.3 lbs., respectively, and on this ration 2.22 lbs. more milk and 0.07 lb. more fat were produced per day per cow.

Further contributions to the physiology of phosphorus and calcium metabolism of dairy cows, E. B. Meigs, N. R. Blatherwick, and C. A. Cary (*Jour. Biol. Chem., 40 (1919), No. 2, pp. 469–500*).—In continuing their work in the Dairy Division, U. S. Department of Agriculture, previously noted (E. S. R., 41, p. 678), the authors, working in collaboration with T. E. Woodward, found that the phosphorus assimilation of dry dairy cows could be increased by a system which reduced the disturbing influence of calcium in the intestines. This result was secured by feeding a double ration of the phosphorus-rich grain ration (corn-and-cob meal, wheat bran, and cottonseed meal, 5:4:2, with or without disodium phosphate) one day without roughage and feeding a double ration of the calcium-rich roughage (alfalfa hay and corn silage) the following day without grain.

So far as could be judged by the data collected during balance experiments, the calcium assimilation was abnormally low, although the cows showed no indication of calcium privation and carried fetuses with well-formed skeletons. Examination of the published records of 136 mineral balance experiments with

cattle, sheep, and pigs showed that in practically every case the ratio of calcium assimilated to phosphorus assimilated was distinctly less than the characteristic ratio of calcium to phosphorus in the skeletons of animals at slaughter. The data compiled by Forbes and Keith (E. S. R., 32, p. 858) show that the latter ratio is quite constantly 1.9 in the case of mature ruminants and 1.6 in the case of swine. The authors argue that if the observed ratios of assimilated calcium and phosphorus in balance experiments represent the actual condition the animals could not have produced skeletons of normal composition, and they conclude that the necessary disturbances to an animal incident to the collection of feces and urine in a balance experiment cause profound disturbances in calcium metabolism.

The feeding of inorganic phosphate was found to increase the phosphorus content of the blood plasma. The relation between the concentrations of plasma phosphorus and urinary phosphorus was not so pronounced, due it is thought to differences in the acid-base equilibrium. There was an inverse relation between the amounts of calcium and phosphorus excreted in the urine, but this relation seemed easily disturbed by other influences, particularly the ratio of acids and bases in the ration.

The influence of calcium and phosphorus in the feed on the milk yield of dairy cows, E. B. Meigs and T. E. Woodward (*U. S. Dept. Agr. Bul. 945 (1921), pp. 28, figs. 3*).—This is mainly a study of the influence of the "alternate feeding with phosphate" procedure (noted above) on the subsequent milk yields of the cows. There were 21 cows of the general herd at Beltsville that were fed the experimental rations during a 2-months' dry period preceding a lactation. The indications were that the milk yields were higher than was expected from previous experience with the herd. For 7 of the cows there was a more complete control in that milk records were available following dry periods in which only the ordinary feeding methods were used. Between the tenth and fortieth days after freshening these 7 cows gave a total of 5,081 lbs. of milk following ordinary feeding and 6,885 lbs. following the alternate rations with disodium phosphate. If the alternate feeding had had no influence on milk secretion, it is estimated that the latter total would have been 4,993 lbs. This figure is based upon the yields after the control feeding, with suitable corrections for age differences and the fact that some of the animals aborted.

The cows in the general herd were fed both during the control and the experimental feeding substantially according to the Savage standard. Cows on 365-day advanced registry tests did not respond noticeably to the alternate-phosphate feeding, but these cows received heavy rations when dry and in the course of the year (including the dry period) they received about 100 per cent more protein and 50 per cent more total nutrients than the Savage standard calls for. The method of feeding on test thus seemed to supply all the phosphorus needs of the cows.

The dosage of phosphorus as $Na_2HPO_4.12\ H_2O$ varied from 4.5 to 24 gm. per day and caused no digestive disturbances.

The influence of calcium and phosphorus in the feed on the milk yield of dairy cows, E. B. Meigs and T. E. Woodward (*Jour. Dairy Sci., 4 (1921), No 3, pp. 185–217, figs. 3*).—Barring minor verbal changes and rearrangement of tables, this paper is identical with the bulletin noted above.

Sunflower silage for dairy cows, G. E. Morton (*Colorado Sta. Rpt. 1920, pp. 19*).—In a briefly reported experiment, cows during a period of feeding on sunflower silage produced 86 per cent of the butter fat and 91 per cent of the milk which they produced during a period of corn silage feeding. Having regard to the increased tonnage per acre, the result is considered not unfavorable to the sunflower silage.

Sunflower silage experience in northern Michigan, D. L. McMillan (*Hoard's Dairyman, 61 (1921), No. 21, pp. 850, 868, fig. 1*).—At the Upper Peninsula Substation sunflower silage was fed to the dairy herd. Change to oat-and-pea silage did not affect production, but when the feeding of sunflower silage was resumed the milk yield declined, due at least in part to advance in lactation. Owing to its greater bulk only 35 lbs. of the oat-and-pea silage was consumed per head daily, whereas the cows would take 40 lbs. of the sunflower silage readily. The oat-and-pea silage was much more expensive to produce.

Sunflower silage v. corn silage [for milk production], E. G. Woodward (*Washington Sta. Bul. 158 (1920), pp. 18–20*).—Eight cows divided into two groups were fed sunflower silage and corn silage by the reversal method for two periods of 40 days each. While on corn silage the cows gave less milk, gained in weight, and consumed more silage and less grain than on sunflower silage. By making a number of assumptions in regard to the relative values of the feeds and allowances for the changes in weight, it is concluded that the sunflower silage was approximately 92 per cent as valuable as the corn silage.

Hydrolyzed sawdust as a stock food (*Wisconsin Sta. Bul. 323 (1920), p. 5–7, fig. 1*).—Pine sawdust hydrolyzed with dilute acid under pressure by the methods described by Sherrard and Blanco, as noted on page 202, was fed by F. B. Morrison, G. C. Humphrey, and R. S. Hulce to 3 dairy cows during a 4-week period. The concentrate ration consisted of sawdust, barley, bran, and linseed meal (6:8:6:3), with alfalfa hay and corn silage as roughage. It is stated that the cows kept up their production and maintained weight during this period even better than when fed barley, bran, and linseed meal (11:6:3) during the preceding and following periods.

The effect of exercise and feed upon the vitality and breeding ability of bulls, E. G. Woodward (*Washington Sta. Bul. 158 (1920), p. 20*).—Daily exercise of Ayrshire, Jersey, and Holstein herd bulls in a treadmill was found to diminish the time required for service in the case of a slow bull and to increase the motility and longevity of the spermatozoa as determined by microscopic examination of samples of semen collected from the vagina of the cows served.

Unit requirements for producing market milk in southeastern Louisiana, J. B. Bain, G. E. Braun, and W. D. Wood (*U. S. Dept. Agr. Bul. 955 (1921), pp. 15*).—This is a report on the cost of producing milk in Tangipahoa Parish, La., in the two years beginning in March, 1918, and is based upon field studies conducted according to the plan followed in previous investigations of this series (E. S. R., 44, p. 774). Records were obtained from 14 farms for the full two years and from 8 others during one year. The data cover 892.6 cow years and the average production was 3,106 lbs. The milk is sent to New Orleans for consumption as fluid milk. The following table summarizes the average feed and labor requirements for the two years:

Miscellaneous expenditures and amounts of feed and labor expended for milk production in Tangipahoa Parish, La.

Basis of computation and season.	Mill feed.	Home-grown grain.	Le-gume hay.	Other hay.	Stover and fodder.	Silage, etc.	Hu-man labor.	Horse labor.	Bed-ding.	Pas-ture charge.	Miscel-lane-ous costs.[1]
Per cow:	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Lbs.*		
October to March..	927	22	118	200	185	1,026	75.3	11.6	4	$2.03	$13.05
April to September	939	5	9	9	17	145	89.2.	12.1	.....	3.55	11.74
Entire year.....	1,866	27	127	209	202	1,171	164.5	23.7	4	5.58	24.79
Per 100 lbs. milk:											
October to March..	70.8	1.6	9.0	15.2	14.1	78.4	5.8	0.9	0.3	.155	.997
April to September	52.2	.3	.5	.5	.9	8.1	5.0	.7	.....	.197	.653

[1] Excluding changes in the inventory value of cows.

There were 1,680 lbs. of manure per cow saved in the winter and 1,380 lbs. saved in the summer. About 43 per cent of the cows calved in the winter period and 42 per cent in the summer. There was little demand for the new-born calves so that the credit for calves was low.

Feed and bedding totaled 49.3 per cent of the gross cost (including depreciation), pasture 4.1, labor 24.2, and other costs 18.2. Depreciation of stock formed 4.2 per cent of the gross cost. Credits for manure equaled 5.5 per cent of the gross cost and credit for calves 1.7 per cent.

During the winter 33.1 per cent of the labor was performed by the managers, 41.9 per cent by hired men, and 25 per cent by women and children. In the summer the corresponding percentages were 28.2, 42.7, and 29.1.

To keep a bull for a year required 1,202 lbs. of concentrates, 779 lbs. of dry roughage, 1,126 lbs. of succulent roughage, 4 lbs. of bedding, and 33.6 hours of human labor, besides pasture costs and miscellaneous charges.

Factors affecting the composition of milk, A. C. RAGSDALE and W. W. SWETT (*Missouri Sta. Bul. 179 (1921), pp. 22, 23*).—An experiment is reported briefly which seemed to indicate that a sudden reduction of the total amount of feed to one-half the normal caused an increase in the percentage of fat although the amount of milk fell off. A sudden change in the protein in the ration did not have a marked effect.

The biology of cow's milk.—The alcohol test and the heat test, E. SELIGMANN (*Ztschr. Hyg. u. Infektionskrank., 88 (1919), No. 2, pp. 333–345*).—In a series of experiments the alcohol and heat tests were applied to fresh milk, old milk, soured milk, sour milk neutralized with soda, milk to which small amounts of rennet had been added, and milk containing added calcium chlorid. It is concluded that the tests are better indications of age than of acidity. The ready coagulability of old milk is thought to be due to the development of a "bacterial rennet." The author appears to have been unfamiliar with the work of Ayers and Johnson (E. S. R., 33, p. 113).

The alcohol test as a means of determining quality of milk for condenseries, A. O. DAHLBERG and H. S. GARNER (*U. S. Dept. Agr. Bul. 944 (1921), pp. 13, figs. 3*).—From a study of the alcohol test under commercial conditions at two evaporated milk factories and under experimental conditions at the Grove City Creamery, it is concluded that this test has possibilities as a practical and reliable test for determining the quality of milk for condensing purposes. The acid test was found inadequate for detecting milk with a tendency to coagulate during the condensing process. No direct relation was found between the coagulation of milk with alcohol and its titratable acidity, but milks of high acidity as the result of fermentation tended to coagulate with alcohol.

Streptococci occurring in sour milk, F. S. JONES (*Jour. Expt. Med., 33 (1921), No. 1, pp. 13–24*).—This is a study of the cultural characteristics of *Streptococcus lacticus* in the attempt to differentiate it from mastitis streptococci.

It was found that the rod-like and coccoid organisms arranged in pairs and chains that are encountered in sour milk fall into several groups. The largest number (designated *S. lacticus* I) ferment dextrose, lactose, maltose, mannitol, and salicin, and fail to ferment saccharose, raffinose, and inulin. A smaller number (*S. lacticus* II) differ from these in being able to ferment saccharose. A third type, which is not common, does not attack mannitol. All types grow luxuriantly at room temperature, coagulate milk, reduce litmus, and produce large amounts of acid in fermented bouillon containing dextrose. The mastitis types differ characteristically in these respects and do not survive in milk of high acidity.

No evidence was found from observations and a critical examination of the literature that *S. lacticus* ever occurs in the udder or in fresh milk. The author was not able to identify this organism among numerous strains of streptococci isolated from saliva, feces, the vagina, or the skin of cows, and offers no suggestions as to how it gets into milk.

Elimination of germs from dairy utensils, M. J. Prucha and H. A. Harding (*Illinois Sta. Bul. 230, abs. (1920), pp. 4*).—The complete bulletin has been noted (E. S. R., 44, p. 371).

Should we have a new milk score card? H. A. Harding (*Jour. Dairy. Sci., 4 (1921), No. 1, pp. 73–77*).—The author claims that the score cards in present use ignore the question of the safety of milk, and suggests a score card in which equal weight (25 points) is given to food value, healthfulness, cleanliness, and keeping quality. Under food value 15 points are allotted to fat and 10 to solids not fat. Under keeping quality, flavor and odor get 15 points, bacteria 5 points, and acidity 5 points. Cleanliness is based entirely upon visible dirt without reference to bottle or cap. Healthfulness, the proposed new division of the score card, is apparently to be based on tuberculin test and pastuerization.

Dairy factory premises and manufacturing processes, L. T. MacInnes and H. H. Randell (*N. S. Wales Dept. Agr., Sci. Bul. 20 (1921), pp. 40, figs. 29*).—Previously noted from other sources (E. S. R., 44, p. 372).

Factory butter making, B. Van der Burg and S. Hepkema (*De Boterbereiding aan de Fabriek. The Hague: Alg. Nederland. Zuivelbond, 1920, 4. ed., rev., pp. VIII+220, figs. 104*).—This is a treatise on commercial butter making, particularly as practiced in whole milk creameries in Holland. Chapters on centrifugal separators, microorganisms in milk, creamery bookkeeping, and milk tests are included.

The estimation of butter fat in cream, H. B. Siegmund and R. S. Craig (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 32–38*).—The authors find that the Babcock method, as ordinarily employed in cream testing on a commercial scale, gives fat percentages in excess of those given by the Roese-Gottlieb ether extraction method. This is attributed to the inclusion of water or acid in the fat column. When, however, the cream samples were tested with an electrically driven Babcock "supercentrifuge" operated at a speed of 1,600 revolutions per minute, the results were very close to those secured by the extraction method. It is also pointed out that it is difficult to secure accurate results with the ether extraction method when the cream samples are partially churned.

A microscopic method of examining butter for microorganisms, G. L. A. Ruehle (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 123–125; abs. in Michigan Sta. Rpt. 1919, pp. 235, 236*).—By the method described 1 gm. of butter is mixed with 1 cc. of hot water in a separator funnel and extracted with 50 or 100 cc. of ether or gasoline. After standing, the aqueous portion, which it was found contains all the bacteria, is drawn off and mixed with an equal volume of sterile sediment-free milk. Smears are then made, and the subsequent procedure is the same as in the Breed method of counting bacteria in milk by means of the microscope.

In 5 samples of butter from pasteurized cream the microscope counts of groups exceeded the plate counts, but in 3 samples of butter made from raw cream and 2 of unknown origin, the plate counts were larger than the microscope counts of groups and in 2 cases larger than the microscope count of individual organisms. Part of this discrepancy is attributed to the failure of some organisms in the smears to take the methylene blue stain.

Statutory standard for ghee, T. K. Ghose (*Analyst, 45 (1920), No. 537, pp. 444–447*).—The author reports Reichert-Wollny numbers, saponification numbers,

and melting points or butyro-refractometer readings of 67 samples of ghee made from milk of individual buffaloes and 166 samples made from mixed milk of several buffaloes. In only one case was the Reichert-Wollny number below 30. The observations were made to determine a standard for buffalo ghee in India, and a minimum Reichert-Wollny number of 28 was taken as a standard to allow for accidental mixture with cow's ghee.

The effect of each ingredient in the manufacture of ice cream, W. H. E. REID (*Missouri Sta. Bul. 179 (1921), pp. 24, 25*).—Observations on the influence of sugar concentration in the mix on the manufacturing process and the quality of the product are reported.

Increase in the sugar content was found to prolong the time of freezing, the effect being more marked at higher sugar concentrations. Maximum swell was obtained when 12 per cent of sugar was added to the mix; the use of greater or less amounts of sugar decreased the overrun. Increased sugar also reduced the temperature of the finished product, increased the hardness, and reduced the time required to melt under summer conditions.

VETERINARY MEDICINE.

A textbook of pathology, W. G. MACCALLUM (*Philadelphia and London: W. B. Saunders Co., 1920, 2. ed., rev., pp. XV+1155, pl. 1, figs. 612*).—This is a second edition of a work first published in 1916, which discusses the general principles of pathology as illustrated by the commoner and more important diseases, and is primarily intended for use as a textbook.

Organic medicinal chemicals (synthetic and natural), M. BARROWCLIFF and F. H. CARR (*London: Baillière, Tindall, & Cox, 1921, pp. XIII+331, figs. 25*).—This volume, which is one of the series of monographs on industrial chemistry edited by S. Rideal, deals with the isolation of natural and the preparation of synthetic organic medicinal chemicals and with their special properties and uses. The various substances thus treated are in general grouped in sections according to their therapeutic uses, including narcotics and general anesthetics, naturally occurring alkaloids and their derivatives, natural and synthetic local anesthetics, antipyretics, and analgesics, organic antiseptics and disinfectants, purgatives, vaso-constrictors, and vaso-dilators, diuretics and uric acid solvents, organo-metallic compounds, the digitalis group, skin irritants, glucosids and neutral principles, and other substances of interest. The last section deals briefly with pituitary and thyroid extracts, thyroxin, vitamins, and saccharin.

Report of the Minnesota State Live Stock Sanitary Board (*Minn. State Live Stock Sanit. Bd. Ann. Rpt., 17 (1920), pp. 25*).—The occurrence of and control work with infectious diseases of live stock during the year are briefly reported upon.

Report of the State board of stock commissioners (*Nev. State Bd. Stock Commrs. Bien. Rpt., 1919–20, pp. 21*).—The occurrence of and control work with diseases of live stock are briefly reported upon.

The preparation of a simplified culture medium for field workers, D. NORRIS (*Indian Jour. Med. Research, 7 (1920), No 4, pp. 704–709*).—The author has further simplified the culture medium in which meat was replaced by caseinogen (E. S. R., 44, p. 577), by evaporating the neutralized filtrate from the hydrolysis to a thick paste of the consistency and color of Liebig's extract or by further drying it to a powder in a desiccator over H_2SO_4. This paste or powder does not require the addition of either peptone or extractives, but may be made up into a solid nutritive medium by the addition of agar and normal salt solution or water. Similar experiments with ordinary fresh and

dried brewery yeast are reported, but the caseinogen is thought to yield a rather better medium.

This medium, to which the name of trypsinoids has been given, is thought to be of particular value for field workers.

Factors influencing anaerobiosis, with special reference to the use of fresh tissue, F. L. GATES and P. K. OLITSKY (*Jour. Expt. Med., 33 (1921), No. 1, pp. 51–68, pl. 1*).—An investigation is reported of the part played by the different factors of the tissue method of anaerobic cultivation in the establishment of strictly anaerobic conditions in the culture tube, methylene blue being used as an indicator of the reduction process.

From the experiments reported the authors suggest the following conditions as indispensable for strictly anaerobic culture: "The substitution of solid vaseline for liquid paraffin oil as an oxygen-resisting seal; the use of large pieces of fresh kidney, the standard size to be upward of 0.6 gm. unless other reducing substances are present in the medium; the addition of peptone or dextrose or both in the form of peptone dextrose broth in fractional percentages to nonreducing media such as ascitic fluid or serum to aid in the prompt establishment of anaerobic conditions; the use of the McIntosh and Fildes jar as a further aid to the prompt deoxygenation of the medium; for reasons of economy the use of smaller amounts of culture medium, for example 7 to 8 cc., under a vaseline seal; and in dealing with anaerobes which may be injured by exposure to oxygen it might be advisable to prepare the medium a day or two in advance and to incubate it under a vaseline seal so that sterility is assured and the anaerobic conditions are already established when inoculation is made. The infected material is then introduced with a capillary pipette in the vicinity of the kidney tissue and the seal restored by gentle heating to melt a portion of the superposed vaseline."

The present status of the problems of anaphylaxis, H. G. WELLS (*Physiol. Rev., 1 (1921), No. 1, pp. 44–83*).—This review consists of a discussion of the most essential problems of anaphylaxis in the light of the more recent contributions to the literature on the subject.

Infection and vaccination by the tracheal route, A. BESREDKA (*Ann. Inst. Pasteur, 34 (1920), No. 6, pp. 361–369*).—In this paper the author discusses pulmonary resistance to bacterial invasion and the possibility of increasing this natural local immunity by repeated intratracheal injections of the organism in question. Experiments with rabbits and guinea pigs are cited, showing on the one hand a decreased resistance to paratyphoid virus when injected intratracheally following injection with bile and on the other hand an increased resistance to living diphtheritic bacilli following three intratracheal injections of dead bacilli.

The suggestion is made of the possible application of this method to the increase in the local immunity of the respiratory tract against tuberculosis by repeated injections of massive doses of tubercle bacilli.

Technique of agglutination, W. F. HARVEY (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 671–681*).—Attention is called to the diversity of opinions as to what is to be taken as the titer of an agglutinating serum and to the diversity of methods of carrying out the agglutination test. In the opinion of the author the titer of a serum can best be expressed in terms of the degree of flocculation produced, the comparative turbidity of the suspensions used, and the dilution of the serum. The scheme for recording the titer of a serum in these terms is described, together with a standardized technique for carrying out the agglutination test.

A note on the best method of obtaining precipitating antisera, W. D. SUTHERLAND and G. C. MITRA (*Indian Jour. Med. Research, 7 (1920), No. 4,*

pp. 669, 670).—As the result of a study of different methods of obtaining precipitating antisera in fowls, the authors recommend the 2-dose method of intravenous inoculation at 3-day intervals, the fowls to be bled the fourteenth day after receiving the last injection of antigen.

Production of high titer sera, W. F. HARVEY (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 682–700*).—This is a brief discussion of certain points which concern the production of high titer agglutinating sera. These include factors limiting the dosage and frequency of dosage in the production of the sera, methods of recording the titer, differential methods of introducing the antigen, the relative value of living or dead and of dried or undried antigen, factors influencing antibody response, and means of maintaining the titer. The principal conclusions drawn are as follows:

Rabbits yield a serum of higher titer and specificity than goats, but the latter yield much the larger amounts of sera and are more convenient to use. Fowls offer the advantage of being easily procurable and cared for and of yielding a serum of high titer and satisfactory specificity.

Intravenous inoculation of antigen is more efficient than intraperitoneal or subcutaneous. No harm results from frequent repetition of intravenous inoculations in goats or fowls with a 7- or 10-day interval between inoculations. The dose of living organisms that can be administered depends upon the organism. A convenient series of doses for the intravenous inoculation of goats with living organisms is the number corresponding to 1, 2, 3, and 4 mg. of dried bacterial substances. Good sera can be obtained by intravenous inoculation of suspensions of killed organisms, while organisms simply desiccated form a very satisfactory, stable, and efficient antigen. The titer of an agglutinating serum once raised can be easily maintained in goats by subcutaneous inoculations.

Methods of standardizing vaccines, T. P. HASLAM (*Amer. Jour. Vet. Med., 15 (1920), No. 10, pp. 463–466*).—This is a brief comment on various methods of standardizing vaccines. The author is of the opinion that standardization by weight or by comparisons of opacity or turbidity is much more accurate than standardization by bacterial count. The technique employed in opacity comparisons by Brown (E. S. R., 45, p. 177) and that of Dreyer and Gardner, previously noted (E. S. R., 37, p. 14), are briefly described.

Researches on the preparation of antimicrobial and antitoxic sera in the horse, M. NICOLLE, V. FRASEY, E. DEBAINS, and E. NICOLAS (*Ann. Inst. Pasteur, 34 (1920), No. 5, pp. 285–333, figs. 51*).—This is the first report of a series of studies extending over several years of methods of obtaining in the horse specific sera containing, either separately or combined, agglutinating properties for the identification of pathogenic organisms and bactericidal and antitoxic properties for the treatment of microbial diseases.

The paper consists of a description of the general technique employed in methods of immunization and titration of the sera, and a discussion of the results obtained in the preparation and standardization of specific antityphoid, antiparatyphoid, antimeningococcic, antigonococcic, anti-Shiga, anti-Flexner, antimelitensis, anticholera, and antigangrene sera. The results obtained in the standardization of these sera are also indicated in a series of curves prepared by E. Césari.

Studies of chronic intoxications on albino rats.—IV, Fluorid, chlorid, and calcium (including sodium fluorid, sodium chlorid, phosphate rock, calcium phosphate (precipitated), and calcium carbonate (precipitated), T. SOLIMANN, O. H. SCHETTLER, and N. C. WETZEL (*Jour. Pharmacol. and Expt. Ther., 17 (1921), No. 3, pp. 197–225, figs. 19*).—Studies here reported, in which sodium fluorid was administered to rats in their food for continuous periods up

to 21 weeks, followed in some cases by after-periods of unpoisoned food, led to the following conclusions:

"Sodium fluorid, eaten with food during long periods in daily doses of 15 to 150 mg. per kilogram of body weight, results in progressive impairment of growth and food consumption. The damage is proportional to the dose. It tends to outlast the administration of the drug, so that the growth of animals that have been poisoned with fluorid remains permanently below that of unpoisoned animals. The diminished food consumption is not due to distaste of the fluorid food, for the animals do not prefer unpoisoned food (except with the highest concentrations).

"The effects are not due to general salt action, for corresponding doses of NaCl are not harmful. Fluorid in the form of phosphate rock produces the same effects as NaF, and in nearly corresponding doses. The deleterious effect of phosphate rock is not shared by other insoluble Ca salts (phosphate and carbonate) in equal concentration. No deleterious effects on growth or food consumption occurred in nine weeks with daily doses of NaF of 8 mg. per kilogram of body weight, or with smaller doses."

[Forage poisoning], Z. NORTHRUP [WYANT] (*Michigan Sta. Rpt. 1919, pp. 242, 243*).—Six of 11 samples of silage which had caused forage poisoning in live stock, representing all but one of the sources, were found to contain an organism resembling *Bacillus botulinus* morphologically and culturally, and the toxin from the culture isolated from one of the samples of silage caused the death of the experimental animals.

Symptomatic anthrax or blackleg, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 29 (1920), Spanish ed., pp. 5–7*).—A brief popular account of this disease, which is known in Porto Rico as morriña negra.

Foot-and-mouth disease: The question of invasion, S. STOCKMAN (*Jour. Compar. Path. and Ther., 33 (1920), No. 3, pp. 153–157; also in Min. Agr. and Fisheries [London], [Vet. Dept.], Ann. Rpts. Proc. 1919, pp. 13–18; Jour. Min. Agr. [London], 27 (1921), No. 11, pp. 1004–1009*).—This is a discussion of the way in which foot-and-mouth disease is from time to time brought into Great Britain and into similarly situated countries, notwithstanding the fact that importation of susceptible live stock into Great Britain is prohibited, as has been the importation of hay and straw since 1908, except for exceptional purposes. It is pointed out that when freed from the disease in enzootic form, Great Britain is only invaded when the disease is prevalent on the Continent, and particularly when it prevails in the north of France, Belgium, and Holland. In the light of recent experience, it would also appear that the greater the prevalence on the Continent the more frequent are the invasions. The outbreaks in Great Britain, apparently, have not been modified by the prohibition of the importation of hay and straw.

The efficacy of the eradication work during the last 20 years, in which the affected animals and actual contacts have been slaughtered immediately, appears to be shown by the fact that recurrences after restocking formerly infected premises with susceptible animals are practically unknown, and that the same premises are almost never hit twice after shorter or longer intervals. Feeding stuffs, packing materials, and human beings, which represent the communication between animals of the farm and the outside world, have naturally fallen under a sustained suspicion, but it has not been possible to establish any relationship. A study of the initial outbreaks that have occurred in Great Britain over a period of 20 years shows that certain parts of the country hit are visited initially with much greater frequency than others, and that some habitually escape altogether. The possibility of the virus being air borne for any distance, either by air currents, birds, or otherwise is considered, and the

evidence available is thought to indicate that particles of virus may be carried by the air.

The outbreak of and control work with rinderpest in Bulgaria during the Balkan war of 1912–13, St. Angeloff (*Arch. Wiss. u. Prakt. Tierheilk., 43 (1917), No. 6, pp. 383–420, figs. 17*).—Rinderpest, which is nearly always present in Asiatic Turkey, was found in four provinces in southeastern Bulgaria. The author deals with its clinical appearance, anatomo-pathological changes, differential diagnosis, and control measures.

Serological studies on tuberculosis.—Third contribution: Concerning precipitins and complement-fixing antibodies, Y. Nishida and S. A. Petroff (*Amer. Rev. Tuberculosis, 4 (1920), No. 5, pp. 322–339*).—In continuation of the investigation previously noted (E. S. R., 42, p. 882), studies are reported of the physical and chemical properties of the antibodies responsible for the complement fixation reaction in tuberculosis, together with a comparison of the complement-fixing antibodies and the precipitins.

Sensitized serum having a high titer of antibodies was obtained by the intravenous inoculation of sheep with human tubercle bacilli. The complement-fixing antibodies in such a serum were found to resist a considerable degree of heat, a temperature of about 70° C. being required to destroy them. X-ray radiation did not appear to destroy the antibody, antigen, or complement. Ultra-violet rays had only slight effect on the antigen, but destroyed the antibody and complement. Sunlight at 1,600 ft. elevation had very little effect on antigen, a slight effect on antibody, and more on complement.

An attempt to determine the chemical nature of the antibodies led to the conclusion that they are not of the nature of lipins but are either globulins or are carried down with the globulins.

A parallel study of the precipitation and complement fixation reactions, using three different antigens and various dilutions of active sera and of sera inactivated by heat, showed that the antibodies responsible for the two different reactions are probably the same but represent two phases of the same phenomenon.

The preparation of tuberculins for the diagnosis of tuberculosis in animals, F. Boerner, jr., and M. F. Barnes (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 160–164*).—The authors call attention to the importance of the adoption of uniform methods for the preparation of tuberculins and discuss briefly the various steps in tuberculin preparation.

Combination tuberculin tests, H. W. Turner (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 165–172*).—Data are presented on the results obtained by the Pennsylvania Bureau of Animal Industry in the use of different combinations of the intradermal, subcutaneous, and ophthalmic tuberculin tests. These data indicate that the intradermal test when applied three days prior to the subcutaneous interferes with the subcutaneous test by developing marked immunity to tuberculin. The application of the subcutaneous test a few days before the intradermal, while having a slight effect on the second test, did not produce as great an interference. The ophthalmic test did not appear to affect or be affected by the other tests when applied in any combination.

"From the results here shown, as well as from the observations of others, it is evident that we are in need of a uniform plan for applying the combination tests."

The superiority of combination tuberculin tests over any other method, L. B. Ernest (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 173–180*).—In this paper the author discusses the experiences of inspectors of the Bureau of Animal Industry, U. S. Department of Agriculture, in the use of the combination tuberculin tests.

During 1919 experiments in testing the value of the separate reactions gave the following results: Positive reactions were obtained in 251 out of 1,216 cattle tested subcutaneously, 278 out of 1,538 tested with ophthalmic reaction, and 328 out of 1,076 tested intradermally. The percentage of animals reacting negatively but showing lesions on post-mortem examination was 5.39 in the subcutaneous, 6.75 in the ophthalmic, and 11.51 in the intradermal test. A report from several of the bureau stations for 1920 showed lesions in 96.12 per cent of the animals diagnosed as tuberculous by the subcutaneous test, 96.17 by the intradermal, and 95.12 by the ophthalmic test.

In the use of a combination of two of the three tests the subcutaneous, checked by the ophthalmic method by sensitizing the eye at the time of the first preliminary temperature reading and using the diagnostic disk at the tenth hour after the subcutaneous injection, is recommended as enabling a check on the subcutaneous test to be made within the time consumed by the subcutaneous test alone. In the combination intradermal and ophthalmic test it is recommended that the injection be made by the intradermal method and the eye sensitized by the ophthalmic disk at the same time. The diagnostic ophthalmic disk should be instilled at the sixty-seventh hour and observations made on both tests at the seventy-second hour or possibly later. "A combination of this character is of special value where the operator is not entirely familiar with intradermal reactions, in which case he will very probably, if the animals in question are tuberculous, have some eye disturbance to guide him in his classification."

A combination of the subcutaneous and intradermal tests, the latter to be applied to those animals failing to react to the former test, is considered valuable as a matter of check testing, but more time-consuming than other combination tests. In conclusion, the author emphasizes the importance of careful post-mortem examination of condemned animals.

Accuracy of tuberculin tests (*Wisconsin Sta. Bul. 323 (1920), p. 31*).—In tuberculin tests conducted on a single large herd of cattle in an attempt to determine the relative value of different methods of testing, the best results were obtained from the combined sensitized ophthalmic and intradermal tests. The intravenous test failed to react in a number of the animals which showed tuberculous lesions at the time of slaughter.

Disposition of tuberculous cattle, O. H. Eliason (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 155–159*).—A brief description is given of a plan conducted in Wisconsin in 1918–19 of salvaging condemned tuberculous cattle by segregation on a concentration farm. The physically fit cows were milked and the milk sold to manufacturers of condensed milk. The calves were sold for veal and the cattle sold from time to time. In the plan as suggested for a permanent State project the equipment should consist of a concentration farm to which all reactors would be sent, the valuable pure breds being conspicuously marked, a second farm to which valuable cows should be sent for breeding, and a third farm where the calves should be sent until tested and passed by two tuberculin tests.

Eradicating tuberculosis in Pennsylvania, S. E. Bruner (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 147–154*).—The policy adopted in Pennsylvania for the control of tuberculosis under the accredited herd plan is outlined and discussed. Attention is called to statistics showing that as the disease decreases the inefficiency of the tests, as shown by inability to demonstrate the disease on autopsy, increases. Various possible causes of reaction in non-tuberculous animals are mentioned, including individual idiosyncracy to tuberculin and erratic normal temperatures. It is thought that the percentage of errors may be reduced by taking into fuller consideration the complete history

of the herd and by slaughtering first those which give the strongest reaction and then determining by the slaughter of one or two of those giving less decisive reactions the disposition of the others.

Botulism in cattle, R. GRAHAM and H. R. SCHWARZE (*Jour. Bact., 6 (1921), No. 1, pp. 69–83, figs. 4*).—Work conducted by the laboratory of animal pathology, University of Illinois, here reported, is summarized as follows:

"An anaerobic bacillus biologically resembling *B. botulinus* (type B) was isolated from a corn silage. Several (18) cattle of the herd consuming the silage in question developed symptoms of forage poisoning on two different occasions and four animals died. It is possible that botulinus toxin in the silage was primarily related to the disease in question. The silage was regarded as unsafe for cattle, and after discontinuing its use in the daily rations the animals remained healthy.

"Botulinus antitoxin (type B) proved efficacious in protecting guinea pigs against lethal doses of toxin in unfiltered broth cultures produced by the anaerobic bacillus isolated from the corn silage.

"An opportunity was afforded to inject 43 cattle on this farm with botulinus antitoxin, and subsequently to feed them with the silage. The animals remained apparently healthy. One control or untreated animal did not show visible illness, and the value of the antitoxin in the feeding operations is therefore not conclusive. It is worthy of record that the treatment did not injure the animals, and encouragement is offered for more extensive field trials in determining the value of the antitoxin in cattle against the ill effects of otherwise nourishing rations containing *B. botulinus* toxin which heretofore has advisedly been discarded. The latter item is of importance considering the increased cost of producing grain and forage."

New method in detection of Johne's disease (*Wisconsin Sta. Bul. 323 (1920), p. 31*).—In tests for Johne's disease conducted by B. A. Beach, 24 of the 325 animals comprising the 7 herds of dairy cattle tested reacted to johnin. Post-mortem examinations were made on 15 of the reacting animals and tissues from them studied under the microscope. Acid-fast bacteria resembling Johne's bacillus were found in all but one case.

A modified method of finding the organisms microscopically was developed which consists in treating a small piece of the suspected tissue with full strength commercial formaldehyde for 1 hour, drying in an incubator or drying oven, powdering the dried tissue, and treating it with 25 per cent antiformin solution for two hours. The antiformin is diluted with an equal volume of distilled water and the sediment examined for the acid-fast organism. In studying the distribution of the organisms in the infected tissue no trace of them was found deeper than the submucous coat of the intestines, thus indicating that the organisms gain entrance to the body from the intestines.

The relation of the bacterial flora of the uterus to that of the meconium of the calf, S. G. BANDEEN (*Michigan Sta. Rpt. 1919, pp. 239, 240*).—"The 24 cases studied for a comparison of the flora of the uterus and meconium showed that the 12 uteri gave cultures in 83⅓ per cent. The uterus contained more organisms than the meconium. The meconium was found to be infected with *Bacillus coli communior*, staphylococcus, and streptococcus. These organisms were also found in the uterus. *Bacterium abortus* was found to persist in the uterus for 28 days. In no case was *B. abortus* found in the meconium. In all cases, except one, whenever the meconium was infected the uterus was found to harbor the same organism. In some cases the meconium was found to be sterile, while the uterus harbored organisms. *B. coli* and certain cocci were found in the sealed uteri of apparently normal cows. The results obtained in this article will be of interest to investigators of white scours of calves who

believe that the calf is infected before birth. A large percentage of calves are born with infected meconium. The uterus is first infected, probably followed by the fluids, and, lastly, the meconium. The infection probably reaches the uterus by passing through the cervix from the vagina before the seal is formed and persisting there throughout pregnancy."

[**Investigations of diseases of pigs and cattle**] (*Wisconsin Sta. Bul. 323 (1920), pp. 32–34, fig. 1*).—Considerable attention was given by F. B. Hadley to the study of the disease of pigs which, when confined to the mouth, is known as sore mouth, or necrotic stomatitis; where the nasal passages are involved, is called "bull nose"; where the lining membrane of the stomach and bowels is affected, necrotic gastritis; and where the lungs are affected, necrotic pneumonia. "The treatment of sore mouth is performed by cutting out the necrotic tissue from the ulcers and applying tincture of iodin. The mouth of the diseased pig, and every pig in the herd as well, should be flushed with a 3 per cent solution of permanganate of potash. Owing to the possibility of transfer of infection from the udder of the sow, it also should be washed with the same solution. The experience of the department is that the disease may be checked by turning all pigs out on pasture. New quarters should be provided, or the old ones cleaned thoroughly and disinfected."

Work with sterility of cows has shown that excellent results have been secured by irrigating the affected organs with a 1 per cent solution of common salt.

In vaccination against contagious abortion, the vaccine was prepared and distributed in sufficient quantity to immunize 850 head of cattle. The indications were that in a large percentage of the cases very beneficial results have followed its use.

Hairless pig trial (*North Dakota Sta. Bul. 146 (1921), pp. 24–28*).—Reports of observations by county agents and others show the State to have been nearly free from hairless litters during the year 1920.

In a comparison of exercise *v.* nonexercise for sows, 19 head were farrowed at the station, the number of normal and hairless pigs being 12 and 2 in the exercise lot, with 2 haired, 7 hairless, and 3 half hairless in the nonexercise lot. The results of 128 farrowings, covering the sizes of hairless and normal litters and the amount of overrun of the standard 16 weeks gestation period, are recorded in tabular form. With the 45 gilts, the litters of which were nearly evenly divided between hairless and normal, the normal ones averaged 26.92 per cent larger than the hairless. With the litters from the 83 sows, all but 8 of which were normal, the normal litters had 9.94 per cent more pigs than the hairless ones.

It is pointed out that hairless pigs are usually weak and very largely succumb during the first three weeks, and that there are other symptoms less readily discerned than hairlessness which are present in hairless litters. A record kept of the percentage of normal litters and of hairless litters that survived the first 10 days show that of 116 hairless pigs farrowed 13 lived 10 weeks, while of 88 normal pigs farrowed 67 lived the same period.

Hog cholera (*North Dakota Sta. Bul. 146 (1921), pp. 46, 47*).—The experimental work on hog cholera reported includes a summary of dialysis, attenuation, and dilution experiments with hog cholera virus.

The virus did not dialyze through either parchment of collodion membranes when normal salt solution or distilled water was used as the dialyzing medium. With normal pig serum as the dialyzing medium the virus evidently passed through both parchment and collodion membranes. Virus through which CO_2 or illuminating gas had been bubbled continuously for 48 hours apparently lost

none of its virulence. Dilution experiments indicated that the virus is viable and potent for susceptible pigs in doses as small as 0.001 cc.

On the morphology and biology of Bacillus suipestifer, A. TRAWINSKI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 80 (1918), No. 6, pp. 339–349, fig. 1*).—In investigations conducted, 42 cultures of *B. suipestifer* were made from the internal organs of 21 head which had succumbed to swine plague. All were found to possess the same morphological, biological, and agglutinating characteristics. A comparison showed them to be identical with the strain of *B. suipestifer* obtained from the Bacteriological Institute at Budapest.

Swamp fever in horses (*North Dakota Sta. Bul. 146 (1921), pp. 45, 46*).—In investigations in which Gastrophilus extract was administered to 18 horses in various ways, including subcutaneous, intradermal and intraperitoneal injection, ingestion, etc., none developed fever or showed anemia. Experiment proved that swamp fever virus loses its virulence within 65 days when preserved in chloroform.

A campaign to control chicken pox, W. C. THOMPSON and L. S. DODSON (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 7, pp. 4, fig. 1*).—The general plan of a campaign for the control of chicken pox, inaugurated by the stations on July 1, 1921, in cooperation with Squibb's Laboratories and with individual poultrymen, is here described. The importance of the disease in New Jersey, where the loss to poultrymen in the fall and winter of 1919 is estimated as having amounted to $1,000,000, is pointed out and its nature described. In conducting the campaign the chicken-pox vaccine will be supplied at cost to any poultryman in New Jersey who makes a request for it and complies with certain conditions.

Wattle test for tuberculosis of poultry (*Wisconsin Sta. Bul. 323 (1920), p. 34*).—This test, which consists in injecting 0.25 cc. of avian tuberculin with a fine hypodermic needle just beneath the outer skin of the wattle, has been used by B. A. Beach with considerable success in eliminating tuberculosis from a flock of 500 chickens. If the bird is tuberculous one or both of the wattles will swell from 2 to 20 times its normal size in from 12 to 48 hours. By testing the entire flock twice each year for 3 years and removing all reactors, the mortality of the flock has been reduced from 15 per cent to less than 1 per cent annually.

The artificial incubation and brooding of turkeys, H. W. GRAYBILL (*New Jersey Stas. Bul. 347 (1921), pp. 11, fig. 1*).—This is a report of investigations conducted at the department of animal pathology of The Rockefeller Institute for Medical Research, at Princeton, N. J., in cooperation with the State Station. The investigations indicate that in the artificial rearing of turkeys, incubation, either throughout or with the use of hens or turkeys until shortly before hatching, and brooding can be carried out with success. Contrary to a common belief, the turkey will flourish under confinement when infections are excluded. Artificial rearing, isolation from adult poultry of all kinds, and the use of noninfectious soil offer promising means of controlling blackhead in young flocks.

Carbon tetrachlorid for the removal of parasitic worms, especially hookworms, M. C. HALL (*Jour. Agr. Research [U. S.], 21 (1921), No. 2, pp. 157–175*).—Following a résumé of some of the more readily available literature on carbon tetrachlorid, especially those papers dealing with the therapeutics of this drug and entomological literature, the author reports experiments conducted by the Bureau of Animal Industry, U. S. Department of Agriculture, with a view to determining its effect upon parasitic worms and upon the animals to which it is administered. In the anthelmintic experiments with dogs it was administered alone, with thymol, and with chenopodium. Comparative

experiments were conducted with chloroform, chenopodium, chloroform and chenopodium, and thymol.

The results obtained led to the conclusion that "carbon tetrachlorid in less than the ascertained effective dosage (0.3 m. p. k.) or improperly administered (without capsules) removed 40 hookworms and left 55, an efficacy of only 42 per cent; but in the effective dosage of 0.3 m. p. k. in capsules it removed all the hookworms from 9 dogs and, judging from the fecal examination, apparently removed all the hookworms from 5 other dogs, an efficacy of 100 per cent. A solution of thymol in carbon tetrachlorid in capsules was likewise 100 per cent effective against hookworms in the 2 infested dogs to which it was given. A solution of chenopodium in carbon tetrachlorid in capsules was likewise 100 per cent effective against hookworms in the one infested dog to which it was given.

"On the other hand, chloroform in doses of 0.1 to 2 m. p. k. in castor oil was only 54 per cent effective against hookworms; in single or repeated doses in soft capsules it was entirely ineffective.

"Chenopodium and its constituents in single or repeated doses have an average efficacy of 20 per cent against hookworms; in the dose commonly employed for removing hookworms from man, three 10-minim doses at 1-hour intervals, it is only 30 per cent effective, and its maximum efficacy in any series of dogs used is only 74 per cent.

"Chloroform and chenopodium for all cases reported shows an average efficacy of 69 per cent, the maximum efficacy for a series being 89 per cent in cases where dogs were given three 5 to 10 minim doses in soft capsules at 1-hour intervals, each dose accompanied by 0.5 oz. of castor oil and followed a half hour later by 4 mils of chloroform in 0.5 oz. of castor oil, this dose of chloroform being in excess of 0.3 m. p. k. for the average dog (a 10-kg. dog).

"Thymol shows an efficacy of 15 per cent and, according to Gaiger's record, left hookworms in 7 of 9 dogs treated, with no evidence as to infestation on the part of the other 2 dogs.

"Nothing heretofore reported for experimental tests of anthelmintics on dogs shows the 100 per cent efficacy for a series of tests against hookworms that carbon tetrachlorid does. The best results heretofore have been obtained by repeated doses of chenopodium followed by chloroform. Chloroform alone appears to be better than chenopodium alone, and thymol makes a very poor showing."

RURAL ENGINEERING.

The Venturi flume, R. L. Parshall and C. Rohwer (*Colorado Sta. Bul. 265 (1921), pp. 3–28, pls. 7, figs. 14*).—Experiments conducted in the hydraulic laboratory at Fort Collins, Colo., at Cornell University, and at the field laboratory at Bellevue, Colo., under a cooperative agreement between the irrigation division of the Bureau of Public Roads of the U. S. Department of Agriculture and the Colorado Station, are reported. The report is intended to present a more complete statement as to the law of flow through the Venturi flume and to define more clearly its limitations and advantages than was done in a previous contribution from the station (E. S. R., 37, p. 282).

It is stated that the Venturi flume is intended to meet those conditions for which the standard weir or other measuring devices are not suited, the most important application being where sufficient head is not available for other types of measuring devices. Its accuracy is said to be sufficient to meet ordinary requirements, and by actual computation it has been shown that for all sizes of rectangular flumes investigated with discharges ranging from less than 1

sec.-ft. to nearly 400 sec.-ft., 94 per cent of all tests show an error in discharge of 5 per cent or less. A similar comparison for the V-notch flume shows that for discharges ranging from 0.1 to 10 sec.-ft., 70 per cent of all the tests show an error of 2 per cent or less.

The following formula is given for discharges through the rectangular Venturi flume:

$$Q=\left[(0.9975-0.0175W)+\frac{(H_d-0.163\ H_a^{\frac{1}{2}})^2}{\left(\frac{8}{20-W}\right)H_a^2}\right]WH_b\sqrt{\frac{2g\ H_d}{1-\frac{9}{49}\left(\frac{H_b}{H_a}\right)^2}}$$

where Q=discharge in second feet, W=width of throat in feet, H_b=head at the throat in feet, H_a=head in converging section in feet, and $H_d=(H_a-H_b)$=difference in the two heads. Logarithmic discharge diagrams for rectangular Venturi flumes varying in width from 1 to 5 ft. are given, based on this formula.

The following formula is given for the discharge through V-notch Venturi flumes:

$$Q=C\frac{H_b^2}{2}\sqrt{\frac{2g\ H_d}{1-\frac{H_b^4}{(2\frac{2}{3}+H_a)^2\ H_a^2}}}$$

where Q=discharge in second feet, $C=0.930+(4.07-1.4H_a)\ (H_d-0.05\ H_a-0.04)^2-\frac{0.362}{e^{80H_d}}$, H_a=upper head in feet, H_b=throat head in feet, $H_d=(H_a-H_b)$=difference in head in feet, $e=2.7183$. A logarithmic discharge diagram corresponding to this formula is also given.

The application of the formulas given is not recommended for determining discharges for flumes having throat widths or depths beyond the limits of those shown in the diagrams, as the results will be only approximations.

In order to obtain the best results from the rectangular Venturi flume, it is recommended that four gauge wells be installed and that the mean reading be used in determining the discharge. Frequent testing of the sensitiveness of the gauge wells is considered advisable. Scales or gauges attached to the inside surface of the flume for determining the head are said to be not sufficiently accurate for general purposes. It is also considered advisable, if the head is available, to operate the flume with the greatest difference in head possible since the accuracy increases as the difference in head increases.

Ground water in the Meriden area, Conn., G. A. WARING (*U. S. Geol. Survey, Water-Supply Paper 449 (1920), pp. 83, pls. 7, figs. 10*).—This report, prepared in cooperation with the Connecticut State Geological and Natural History Survey, deals with the geography, geology, and ground water supplies of an area in the south-central part of the State of Connecticut.

Analyses of samples of ground water from various parts of the area are reported, showing a range in total dissolved solids of from 80 parts per million of water in a well ending in till to 367 parts per million in a well ending in trap. The lowest average of total solids was shown by spring waters. In general, the waters from the rock formations were noticeably more highly mineralized than those from the glacial drift. Nearly all of the waters are of the calcium carbonate type. Chlorids were found to form only a small percentage of the total dissolved solids. Nitrates reached a maximum amount in the water from a well ending in stratified drift. The high nitrate content of this water and some of the other waters may be due to the presence of considerable organic matter, but it is considered evident that pollution exists in a number of the waters.

Surface water supply of Missouri River Basin, 1917 (*U. S. Geol. Survey, Water-Supply Paper 456 (1921), pp. 242+XLII, pls. 2*).—This report, prepared in cooperation with the States of Colorado, Montana, Wyoming, and Kansas, presents results of measurements of flow made on streams tributary to the Missouri River Basin during the year ended September 30, 1917.

Surface water supply of the Pacific slope of southern California, H. D. McGLASHAN (*U. S. Geol. Survey, Water-Supply Paper 447 (1921), pp. 557, pls. 18*).—The result of measurements of flow made, in cooperation with the State of California, on streams and basins of the Pacific slope of southern California are presented.

Surface water supply of Pacific slope basins in California, 1918 (*U. S. Geol. Survey, Water-Supply Paper 481 (1921), pp. 314+XXXVIII, pls. 2*).—This report, prepared in cooperation with the States of California and Oregon, presents the result of measurements of flow made on streams in the drainage basins of the Pacific slope in California during the year ended September 30, 1918.

Coeur d,Alene Lake, Idaho, and the overflow lands, R. W. DAVENPORT (*U. S. Geol. Survey, Water-Supply Paper 500–A (1921), pp. [2]+31, pls. 3, figs. 4*).—This report deals with the general features and physical conditions of Coeur d'Alene Lake in Idaho and its overflow lands, the purpose being to render a statement in connection with a controversy between a water-power company and the land owners as to the rights of the company in causing overflow of the lands.

Hydrology and agricultural use of water in Tunis, P. LANDESQUE (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul. 24 (1920), No. 102, pp. 201–258, pls. 4, figs. 4*).—This is a general report on the surface and subsurface water supplies of Tunis and their use for irrigation.

Data on rainfall and on the movement of water supplies are given in the first chapter, with special reference to deep infiltration and ground-water movement. Attention is also drawn to the hot springs and geysers. It is stated that the waters of Tunis are in general highly mineralized, containing mostly salts of sodium, calcium, and magnesium.

The second chapter deals with the improvement of water courses and sources and the use of the surface water for irrigation. General data are given on the design of dams, reservoirs, and canals, and specific structures are briefly described.

A third chapter deals with the influence of forests in the improvement of water-supply conditions in Tunis.

An appendix gives data on the quality of Tunisian water supplies.

Drainage settles peat marshes (*Wisconsin Sta. Bul. 323 (1920), pp. 39, 40*).—Drainage experiments in peat soil conducted by E. R. Jones and G. R. B. Elliott have shown that the settling of peat deposits is limited in nearly all cases to that above the tile. Settling was found in the grade line of the tile only where the water table fell below the tile. These results are taken to indicate that the decomposition of the peat proceeds at the greatest rate in well-drained soil. The records also indicate that half of the settling during six years occurred during the first two years of drainage.

Are concrete tile durable? (*Wisconsin Sta. Bul. 323 (1920), p. 39*).—Investigations on the efficiency of concrete tile in six counties, by G. R. B. Elliott, showed that in soils free from acid, well-made concrete tile disintegrate but little, but where the tile was laid in peat soils quite marked disintegration occurred. The action appeared to be between the soil acids and the cement so that the tile gradually dissolved and crumbled.

On this basis the following specifications were prepared and accepted for use by concrete tile manufacturers: Mixture 2½:1 or richer by weight, controlled vapor for curing, washed sharp aggregate, density sufficient to prevent absorption exceeding 7 per cent, and extra wall thicknesses and densities for tile to be used in acid soils.

Testing war-salvaged explosives for land clearing (*Wisconsin Sta. Bul. 323 (1920), p. 40*).—Winter tests made under cold temperature with dry Grade—II TNT and with moist materials, by J. Swenehart, showed that freezing temperatures have no effect on either its detonation or strength. TNT containing from 5 to 10 per cent of water when frozen showed no different detonation than when the material exploded was at ordinary temperatures.

It was also found that Grade—III TNT is less sensitive than either Grade—I or Grade—II. It was found better to detonate TNT with a primed dynamite cartridge than with No. 8 caps alone. A small percentage of moisture in grenade powder was found to interfere with detonation. Black blasting powder was also found to be too insensitive and to be affected by moisture.

Analysis of roughness impact on highway bridges, W. Whited (*Engin. News-Rec., 86 (1921), No. 14, pp. 582, 583, fig. 1*).—An analysis of the impact on highway bridges due to roughness of the road is presented.

The phases of the subject analyzed are (1) the impact produced when a truck wheel strikes an obstacle and (2) the impact when it jumps off the obstacle. Floor irregularities are considered to be the principal source of impact, and a formula is derived which indicates that when a wheel strikes an obstacle there is an increase of two-thirds the load for 3-in. roughness.

It is concluded that the most logical basis for computing impact in any member of a highway bridge is to assume that "to add to the maximum stress due to the assumed maximum static load a stress equal to that due to a single load about two-thirds the sprung load on any wheel, applied at whatever point on the bridge floor, will give the maximum stress in the given member."

Impact under high-speed traffic on highway bridges, W. D. Uhler (*Engin. News-Rec., 86 (1921), No. 14, pp. 583, 584*).—An analysis of impact of trucks on highway bridges leads to the conclusion that it is sufficient to provide for an obstacle 3 in. high, and that "if bridges are designed for the specified load applied statically with an additional impact load of one specified wheel load plus about 20 per cent, applied at whatever point on the bridge will produce a maximum stress in the member under consideration, ample allowance will be made for all impact stresses, and 20 per cent impact on all wheels will give a wide margin of safety."

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 1, pp. 24, figs. 6*).—This number of this periodical contains the usual project statement under Federal-aid allowances approved in March, 1921, and the following articles:

Crushed Stone and Gravel Roads, by C. L. McKesson and A. F. Morris; British Road Classification; Capillary Moisture and Its Effect on Highway Subgrades, by W. W. McLaughlin; Scholarship Essay Contest Announced; Bituminous Pavements Laid on Old Macadam Streets in Denver, by J. W. Johnson; The President's Message on Federal Highway Policies; and Sand and Gravel Production Survey of Twenty-two States, by G. E. Ladd.

Investigation to determine the draft of various farm implements (*Missouri Sta. Bul. 179 (1921), p. 14*).—Investigations by M. M. Jones to determine the influence of speed upon the draft and power consumption of a 2-bottom, 12-in. general purpose plow, drawn by a tractor, showed that increasing the

plow speed increased the draft and the power consumption of the plow very materially. Increasing the plow speed from 2 to 3 miles per hour, which increased the work done 50 per cent, increased the draft 11.3 per cent and the power consumption 67 per cent; increasing the plow speed from 2 to 4 miles per hour, which increased the work done 100 per cent, increased the draft 24.8 per cent and the power consumption 149.5 per cent.

Sharpen the sickle to save the horse (*Wisconsin Sta. Bul. 323 (1920), p. 40*).—Draft tests made on a used mower by F. W. Duffee with the cutter bar in good and poor condition showed that when the knife was dull and the bar in poor adjustment, the draft was increased from 30 to 35 per cent. Very little was gained by sharpening the knife and leaving the bar in poor adjustment.

Unprotected electric lights.—A recently developed dust explosion and fire hazard, D. J. Price and H. R. Brown (*U. S. Dept. Agr., Dept. Circ. 171 (1921), pp. 7, fig. 1*).—Experiments to determine whether or not the exposed filament in a broken electric lamp will remain hot long enough after the globe is broken to ignite a surrounding dust cloud are reported.

The tests were made in an explosion chamber fitted with a socket to hold lamps of various sizes, and a rod with trigger release to smash the lamps. A dust cloud was produced by blowing dust from small shelves along the side of the chamber. Explosions were obtained with both vacuum and gas-filled lamps. The only exception was with vacuum tungsten and carbon lamps of very low wattage. It is concluded therefore that dust explosions and fires can be caused by the breaking of an electric lamp in a dust cloud.

Tests made to ascertain the danger due to the ignition of the dust on the globe are also reported. Temperature readings of the various types of vacuum and gas-filled lamps on the market were compared with the ignition temperatures of the various dusts found in industrial plants. It was found that the temperature of the dust must be raised at least 150° F. above the maximum temperature of the bulb to cause ignition. In a specially construced chamber, in which a continuous dust cloud may be maintained, it was found possible to start a fire on the larger gas-filled lamps with each of four different carbonaceous dusts. It is believed from these results that any combustible dust, if allowed to collect on a lamp in sufficiently thick layers and remain long enough, will ignite. Methods of fire and explosion prevention are discussed.

Methods for close automatic control of incubating temperatures in laboratories, J. T. Bowen (*U. S. Dept. Agr. Bul. 951 (1921), pp. 16, figs. 13*).—Methods and apparatus for the close automatic control of incubating temperatures used in the Bureau of Animal Industry are described and illustrated and structural features are discussed.

RURAL ECONOMICS AND SOCIOLOGY.

The bases of agricultural practice and economics in the United Provinces, India, H. M. Leake (*Cambridge, England: W. Heffer & Sons, Ltd., 1921, pp. VII+277, figs. 10*).—The origin of agriculture, the physical bases of plant growth, and the development of crop cultivation, together with the application of general economic principles to agriculture are discussed in this series of classroom lectures. The author adheres closely in his illustrations to Indian agriculture, institutions of land holding, customs, and living conditions. The rôles of the large landholder, the Government, and the money lender in the future development of the agriculture of the country are outlined.

Rural New York, E. O. Fippin (*New York: Macmillan Co., 1921, pp. XVI+381, pls. 9, figs. 36*).—This volume is the first of a new Rural State and Province Series, edited by L. H. Bailey. It gives a description of the physical

conformations and climatic conditions of the State, and of the historical development of agriculture there, with an account of agricultural and other related resources. Markets and marketing facilities, rural manufactures, and administrative and regulatory as well as educational and research organizations are outlined.

[Report of the work of the rural life department] (*Missouri Sta. Bul. 179 (1921), pp. 45–49*).—The results of a number of projects not noted before are reported on as follows:

Tractor and other farm equipment costs on the farm, O. R. Johnson and R. M. Green (p. 45).—The equipment charge for horsepower equipment and smaller tools is frequently prorated to different enterprises on the basis of the number of horse hours expended, and equipment charge is therefore expressed in terms of cost per horse hour. A summary of these costs given here indicate a range of from 2.3 cts. in 1914 to 3.7 cts. in 1918, and in cash outlay for repairs, replacements, and additions in percentage of average inventory values of from 28 per cent in 1914 to 42 per cent in 1918.

Cost of producing farm products under farm conditions, O. R. Johnson and R. M. Green (pp. 45, 46).—The work of setting up quantitative cost formulas from data contained in 16 sets of accounts from 14 counties is reported on. Using the "wheat formula," the cost of producing the 1919 crop in Missouri was determined in July, 1919, as being $25.27 an acre. The yield was estimated at 13 bu. to the acre, giving a cost per bushel of $1.94. The final yield reported for the year was 13.5 bu., on the basis of which the cost per bushel would have been $1.87. Using the same formula the average cost per bushel of wheat at 1920 prices is said to have been determined as $2.26 on the basis of a 12.75-bu. yield. The average total labor requirements of various crops included in this study are tabulated.

The agricultural and market value of Missouri farm lands, O. R. Johnson and R. M. Green (pp. 46, 47).—A plan of obtaining the agricultural value of Missouri farm lands on the basis of 1910 data for average acreage and yields and average prices for the 1900–1910 period, as well as certain cost of production figures, is outlined here, and a partial report of results including eight counties is given.

Land tenure in Missouri, O. R. Johnson (p. 47).—This brief report indicates that the share tenant has the least capital, obtains the more fertile land, and is a better feeder of live stock, getting $145 for each $100 worth of feed fed, compared to $126 for the cash tenant. The latter, however, is said to be doing the bigger live-stock business. The share tenant was found to pay 82 per cent more rent to the acre than does the cash tenant, and to pay the landlord nearly twice the interest on investment that the cash tenant pays.

The standard of living on the farm as a factor in the cost of production, O. R. Johnson and R. M. Green (p. 47).—Household expenses of 12 or 14 farms that kept complete accounts continuously for several years are tabulated. The average cash household expense per farm was found to have increased from $416 in 1914 to $1,082 in 1920, or 260 per cent.

Utilization of labor on the farm, O. R. Johnson and R. M. Green (pp. 48, 49).—The man and horse hours required in the various operations of corn growing under north Missouri conditions in 1914 when the corn is gathered from standing stalks and when gathered from the shock, are tabulated here.

Importance of farm cost accounting, W. M. Jardine (*Kansas State Bd. Agr. Quart. Rpt., 39 (1920), No. 153, pp. 35–48, fig. 1*).—It is said that in view of the difficulties involved in obtaining figures on the cost of producing farm products, it becomes a function of the State and Federal governments to determine these costs and obtain the other information needed. A brief account is

given of the cost of production investigations by the Kansas Experiment Station, cooperating with the Office of Farm Management and Farm Economics of the U. S. Department of Agriculture, and the cost per acre of growing the 1918 crop of wheat on 300 farms in 12 counties in Kansas is tabulated in detail. The 1917 business on a Kansas farm, showing expenses and their distribution by complete cost accounting, is also tabulated.

[Cost of production on the North Dakota College demonstration farms in 1920], E. I. OLSEN (*North Dakota Sta. Bul. 148 (1921), pp. 4–33, 36–38, fig. 1*).—Farming operations followed on the various fields of the 19 demonstration farms in 1920 are set down briefly, and costs are computed from accounts rendered in superintendents' reports, using certain unit values found in U. S. Department of Agriculture publications. Crops and yields are tabulated.

The farmer's economic problem, H. C. TAYLOR (*Kansas State Bd. Agr. Quart. Rpt., 39 (1920), No. 153, pp. 26–35*).—Figures relating to the cost of producing cotton in 1913 and in 1918 on different farms in Sumter County, Ga., are tabulated for the purpose of illustrating the differences between average cost and bulk-line cost, and to point out the necessity of having the price somewhat above the average cost if farmers are to prosper in the production of an important staple crop.

Records from 35 McPherson County, Kans., farms are also tabulated. From these it is indicated that the average cost of producing wheat in 1919 was $2.43 per bushel. About 60 per cent of the wheat was produced at an average cost or below, but in order to cover the cost of 85 per cent of the product it would be necessary for the price to go slightly above $2.95. Another table is given showing the basic requirements in producing an acre of wheat on the basis of data from the same group of farms, all of this being given to show the kind of cost data which can be obtained and to indicate the way in which it should be interpreted.

The subjects of farm finance and farm labor problem are also briefly discussed.

A system of accounts for live-stock shipping associations, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 4, p. 14*).—Blank forms and brief descriptive notes are offered.

A system of accounts for cooperative warehouses, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 5, pp. 30*).—As a result of a survey of the accounting methods used at a number of points in the State, various distinct types of accounting were found. The system outlined in this bulletin is offered to enable cooperative warehouses to comply with requirements of the law and to facilitate the making of income-tax returns.

A system of accounts for cheese factories, C. N. WILSON (*Wis. Div. Markets Bul., 1 (1920), No. 8, pp. 16*).—The suggested accounting blanks and brief interpretive text are presented with the idea of assisting the standardization of business methods in the cheese industry of Wisconsin.

International yearbook of agricultural legislation (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Lég. Agr., 9 (1919), pp. LIX+1130*).—This volume continues information previously noted (E. S. R., 42, p. 390).

Foundations of agricultural prosperity, R. T. ELY (*Chicago: Amer. Farm Mortgage Bankers' Assoc., 1920, pp. 15*).—In this address the effect of the tax exemption feature of many modern securities in influencing investment otherwise than in land is pointed out. It is said that real estate taxation is higher in the United States than in foreign countries, and figures are given in support of the statement. Investigation of land economics and the relation of land and agricultural labor are urged, and attention is called to The Institute for Research in Land Economics, established in October, 1920.

Farm tenancy leads to ownership (*Wisconsin Sta. Bul. 323 (1920), p. 48*).—This brief note indicates that from a recent survey of farm tenancy in Wisconsin, by B. H. Hibbard and J. D. Black, the facts were brought out that during recent years ownership is delayed to a later period in a man's life, and that for the first purchase of land by the men interviewed five-sixths of the money required was furnished by relatives or by retired farmers of the neighborhood.

The world's wheat problem, R. T. Hinckes (*Hereford, England: Hereford Times, Ltd. [1920], 2. ed., pp. 15*).—This subject is presented from the point of view that a certain amount of home-grown wheat is important in British national economy. Prewar tendencies toward the development of specialized markets and special trade between countries, upward trends in prices, and various factors operating to check the expansion of the world's wheat acreage are discussed, and the existing world supply and demand are estimated. The passing of local wheat mills in England, and the competition of oats, barley, and other grains that are easily fed to live stock are given as considerations in the decrease of home-grown wheat. The guarantee system of encouraging home production is held to be ineffective, and option contracts are favored. It is said, however, that the high prices then prevailing will inevitably increase the immediate world production.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), Nos. 4, pp. 37–48, figs. 2; 5, pp. 49–60, figs. 2*).—Monthly estimates of crop acreage, condition, and yields, with summaries and comparisons over various periods and the usual data relating to farm value and prices, numbers of live stock, and the farm labor supply are given in these numbers. In the first-named, brief notes summarizing field reports on April 1, 1921, by States in regard to important crops are also included. A special tabulation of the acreage and value of crops grown in 10 Southern States, 1916 to 1920, inclusive, and five-year averages for the periods 1915–1919 and 1910–1914 is presented in order to bring out the extent of diversification in the cotton-producing section.

No. 5 consists largely of reports on the condition of crops and farm animals May 1. A special tabulation, graphically illustrated, indicates the estimated yearly acreage tonnage of 11 crops hauled on country roads, 1915–1919.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 19, pp. 289–304, figs. 4; 20, pp. 305–320; 21, pp. 321–336, figs. 2; 22, pp. 337–352*).—Abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given. Special articles in No. 19 set forth the use of lard substitutes, review the development of wheat production in Argentina, and present a summary of milk marketing costs found in Columbus, Ohio. No. 20 contains a brief article showing wheat exportations from Australia through a period of years. In No. 21 there are special articles setting forth the expansion of the world's trade in condensed milk and describing the importance of the grain hay crop west of the Rockies.

Wisconsin agricultural statistics for 1919, annual crop and live-stock review, J. A. Becker (*Wis. Dept. Agr. Bul. 28 [1920], pp. 99, figs. 12*).—General summary notes are given showing estimates of the acreage and value of 27 crops, including flaxseed and timothy seed, also the number of farms, land values, and farm wages in Wisconsin in 1919, with comparisons of data for earlier years. Discussion, tables, and graphs show the increase in average crop yields in the United States and Wisconsin since records of crops were first

made in 1866. Thirty-two tables embody statistical information secured cooperatively by State and Federal officials.

Live stock and animal products statistics, 1909–1919 (*Canada Bur. Statis., Live Stock and Anim. Prod. Statis., 1909–1919, pp. 131, pls. 2, figs. 27*).—The present report introduces a series designed to cover production and trade in Canada during the war period and in prewar years for comparison. Tables are offered summarizing data from censuses, annual reports, monthly records of imports and exports, cold storage holdings, and wholesale and retail prices, and other official sources. These tables relate to live stock, meats and dairy produce, the international market situation, and prices in Canada. Charts are given illustrating variously animals on farms; monthly cold storage holdings; annual British importation of meats and produce, showing also Canada's net exports and British import prices, 1900–1918; United States foreign trade in meats and dairy produce, showing also wholesale prices at the principal markets compared with Dun's index numbers, 1895–1918; and comparison of live stock receipts at the principal markets with prices.

[Agricultural and live stock statistics of Finland] (*Statis. Årsbok Finland, n. ser., 16 (1918), pp. 124–160; 17 (1919), pp. 94–115*) —Agricultural statistics in these volumes continue the series previously noted (E. S. R., 41, p. 388).

Prices and wages in India (*India Dept. Statis., Prices and Wages India, 35 (1920), pp. [VII]+244, figs. 2*).—Wholesale and retail prices of food grains, other agricultural products, and live stock, as well as wages, have been added to similar statistics for previous years, bringing up to the year 1919, and in some cases up to 1920, the series previously noted (E. S. R., 42, p. 291).

AGRICULTURAL EDUCATION.

R U S : A register of the rural leadership in the United States and Canada, compiled by L. H. Bailey (*Ithaca, N. Y.: Author, 1920, pp. 533*).—This revised edition of the rural Who's Who, previously noted (E. S. R., 41, p. 897), contains 4,631 entries. Directories are also appended of the national agricultural and rural societies in the United States and Canada, journals devoted to agriculture and rural life, official provincial and State departments of agriculture, and the colleges and schools of agriculture.

Agricultural education conference (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1921), No. 11, pp. 177–179*).—The outstanding features are given of committee reports submitted at the fourth annual regional conference of State supervisors and teacher trainers of the southern region, held at Montgomery, Ala., January 3–5, 1921.

It was recognized that in the organization of a year's work in vocational agriculture teachers should make a thorough survey of their particular communities. The course of study should be issued and its length prescribed by the individual teacher rather than the State supervisor or the State office. The course should be based upon a careful analysis of the farm enterprises and farm jobs, both productive and nonproductive. Farm shopwork should become an integral part of the agricultural course rather than a separate course.

It was recommended further that separate departments responsible directly to the institutional administration should be organized in teacher-training institutions. Teacher-training work as a whole should begin in the junior year, and a committee of the agricultural faculty in the agricultural college should be organized to study curriculum problems in the training of vocational teachers. The teacher-training department should continue training its graduates after they have become vocational teachers through itinerant teaching

for at least one year. All members of the teacher-training staff should have an opportunity to do some itinerant teacher-training work, and likewise, all itinerant teachers should be given an opportunity to do some resident work. More or less opposition was expressed to the idea of having local teachers away from their respective localities during the summer months, and where summer schools are offered, they should be for men who have not completed either the technical or professional work in teaching. When teachers are required to be away from their localities for more than four weeks at a time a substitute teacher should be engaged to supervise the practical work. A definite recommendation was that a short intensive course, not to exceed four weeks in length, for State supervisors and teacher trainers now in service, be given at some point within the southern region during 1921, in cooperation with the Federal Board for Vocational Education.

Statements are made of the minimum standard approved for directed or supervised practice work; the fundamentals approved for part-time and evening work and for vocational education for negroes; means for advertising and promoting vocational agricultural education within the respective States; community activities considered a definite part of the agricultural teacher's job; courses recommended in teacher-training work; and conditions for judging the work of the local teacher by itinerant men.

Third annual report of the State Board for Vocational Education, 1920, T. E. JOHNSON ET AL., M. L. BURTON, F. S. KEDZIE, and F. JEFFERS ([*Mich.*] *Bd. Vocat Ed. Bul. 209 (1920), pp. 20*).—This is the report of progress in vocational education in Michigan for the year ended June 30, 1920. During the year 59 schools offered courses in vocational agriculture with a total enrollment of about 2,650 students in agriculture. The agricultural instructors were employed for the 12 months of the year. Thirteen all-day schools, with a total enrollment of 1,319 students, and 10 evening schools, with a total enrollment of 2,446, had courses in vocational home economics. There were 61 teachers in training in vocational agriculture and 60 in vocational home economics at the Michigan Agricultural College, and 15 in home economics at the Michigan State Normal College. Statistical tables are included.

Proceedings of the first national conference on rural school consolidation (*Bul. Iowa State Teachers Col., 20 (1920), No. 4, pt. 2, pp. 85*).—This report of the proceedings of the first national conference on rural school consolidation held at Cedar Falls, Iowa, February 17–19, 1920, includes brief surveys of the present status of the consolidation of rural schools in the various States, and among others, committee reports and papers on the course of study, the preparation of teachers, some things we have learned about rural school consolidation, the problems of transportation and good roads as related to consolidation, the advantages and disadvantages of the various units of taxation and administration, the rural high school in connection with and as made possible by rural school consolidation, the need of more money in the consolidation of schools, and the library in the consolidated schools.

[Nature study] (*Nature-Study Rev., 17 (1921), No. 2, pp. 47–51, 55–86, fig. 1*).—This issue includes a report of the proceedings of the fifteenth meeting of the American Nature Study Society held December 29, 1920, and the following papers:

A survey of twenty years' progress made in the courses of nature study, A. J. Patterson (pp. 55–62).—The author summarizes her survey as follows: "The earliest outlines and courses were largely in the form of questions. Few of them made any attempt to grade the work. Most of them were overtechnical for children. The period from about 1897 to 1905 brought out a large number of graded courses with many helpful books, outlines, and suggestions for teach-

ing. The 10 years from 1905 to 1915 saw nature-study outlines in most of the State courses and in a large number of city systems. The courses were in the main uniform both in the matter of material used and the method of attack. The last 5 years has been a period of sifting and shifting, of revising and testing in the light of child study, which has resulted in a better adaptation of the material and method to the needs of developing children."

A survey of twenty years' progress in nature study in providing materials for study, E. E. Shaw (pp. 63–67).—This is a discussion of the progress made along the lines of choice and use of nature-study materials.

A survey of twenty years' progress in measuring results in nature study, E. R. Downing (pp. 68–70).—This is a copy of the author's revised range of information test in science.

A survey of twenty years' progress in nature study in extension work, A. F. Satterthwait (pp. 71–80).—The author discusses the progress made in the various phases of extension work, including corn-growing contests begun in 1901 in Illinois, boys' clubs started in 1902 in Ohio, and farmers' cooperative demonstration work in the South begun in 1904 and developed to include girls' clubs in 1910, together with results of the work.

Reaching and training rural teachers, E. L. Palmer (pp. 81–86).—An attempt to so simplify and organize the sources of information available to rural teachers that nature study may practically take care of itself is presented.

Syllabus of an introductory course on part-time education (*Calif. Univ., Vocat. Ed. Bul. 1 (1920), pp. 190, fig. 1*).—This syllabus is intended for administrators and teachers of special classes to be established under the California compulsory part-time education act, approved May 27, 1919. Among the topics outlined are Part-time Education in Agriculture, by F. L. Griffin and S. H. Dadisman, and Part-time Education in Home Economics—Organization and Administration, Class Organization and Courses of Study, by M. I. Murchie. The text of the law, an article on Instruction in Vocational Agriculture in Wood County, Wis., by W. S. Welles, etc., are appended.

MISCELLANEOUS.

Thirty-third Annual Report of Colorado Station, 1920, C. P. Gillette et al. (*Colorado Sta. Rpt. 1920, pp. 42*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, a report of the director on the work of the station, and departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Idaho Station, 1920, E. J. Iddings (*Idaho Sta. Bul. 122 (1921), pp. 64, figs. 3*).—This contains the organization list, a report of the director, and financial statements for the Federal funds for the fiscal year ended June 30, 1920, and for the remaining funds for the fiscal year ended December 31, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Louisiana Stations, 1920, W. H. Dalrymple (*Louisiana Stas. Rpt. 1920, pp. 32*).—This contains the organization list, a financial statement regarding the Federal funds for the fiscal year ended June 30, 1920, and the State funds for the fiscal year ended December 31, 1920; and a report by the director, including brief departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Michigan Station, 1919, R. S. Shaw et al. (*Michigan Sta. Rpt. 1919, pp. 227–734, figs. 124*).—This contains a financial statement for the year ended June 30, 1919; reports of the director and heads of departments on the work of the station during the year, the experi-

mental features of which have been for the most part abstracted elsewhere in this issue, and reprints of Bulletins 282–284, Special Bulletins 90–97, Technical Bulletins 43 and 44, and Circulars 36–40, all of which have been previously noted.

A report of work at McNeill Branch Experiment Station, from 1912 to 1917, inclusive, E. B. FERRIS (*Mississippi Sta. Bul. 188 (1920), pp. 23*).—The experimental data included in this report are for the most part abstracted elsewhere in this issue. Meteorological observations are also summarized, as noted on page 210, and a discussion is included of the progress made in live stock and horticultural investigations.

Report of work at South Mississippi Experiment Station for 1918, 1919, and 1920, E. B. FERRIS (*Mississippi Sta. Bul. 194 (1920), pp. 3–23*).—Work at this substation, located at Poplarville since its removal from McNeill in 1919, is reported for the seasons of 1919 and 1920. Data relating to field crops are noted on page 223 of this issue.

What the agricultural experiment station is doing for Missouri, July 1, 1919, to June 30, 1920, F. B. MUMFORD (*Missouri Sta. Bul. 179 (1921), pp. 60, figs. 17*).—This contains the organization list, a report by the director on the work and publications of the station, and a financial statement for the Federal funds for the year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of New York Cornell Station, 1919, A. R. MANN (*New York Cornell Sta. Rpt. 1919, pp. CIV+1106+8, pls. 57, figs. 135*).—This report, presented as usual as that of the dean and director of the New York State College of Agriculture and the Cornell Station, contains the organization list, data relating to the work and publications of the station, a financial statement for the fiscal year ended June 30, 1919, and reprints of Bulletins 398 and 399 and Memoirs 13–27, all of which have been previously noted.

Thirty-third Annual Report of New York Cornell Station, 1920, A. R. MANN (*New York Cornell Sta. Rpt. 1920, pp. 79+4*).—This report embodies data corresponding to the above for the fiscal year ended June 30, 1920, but contains no reprints of bulletins or other publications.

Report of the director, July 1, 1919, to June 30, 1920, P. F. TROWBRIDGE (*North Dakota Sta. Bul. 146 (1921), pp. 48, figs. 7*).—This contains the organization list, a report of the director, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twelfth to Eighteenth Annual Reports of Edgeley Substation, 1914–1920, O. A. THOMPSON (*North Dakota Sta. Bul. 145 (1921), pp. 44*).—This bulletin contains meteorological data and brief summaries of the lines of work at this substation from 1914 to 1920, inclusive. The experimental work reported is for the most part abstracted elsewhere in this issue.

Fifteenth Annual Report of the State demonstration farms, 1920, E. I. OLSEN (*North Dakota Sta. Bul. 148 (1921), pp. 38, figs. 8*).—Weather conditions during the growing season of 1920 and data as to cost of crop production, yields, and wheat milling and baking tests are briefly summarized. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Texas Station, 1919, B. YOUNGBLOOD (*Texas Sta. Rpt. 1919, pp. 26*).—This contains a report of the director on the work of the station and the various substations, and a financial statement for the Federal funds for the fiscal year ended June 30, 1919, and for various State

funds for the fiscal year ended August 31, 1919. The experimental work reported with rice and cotton is abstracted on page 229.

Thirtieth Annual Report of Washington Station, 1920, E. C. JOHNSON (*Washington Sta. Bul. 158 (1920), pp. 47*).—This contains the organization list, a report on the work and publications of the station during the year, and a financial statement for the Federal funds for the fiscal year ended June 30, 1920, and the remaining funds for the fiscal year ended March 31, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

New farm facts: Annual report of the director for 1919–20, H. L. RUSSELL and F. B. MORRISON (*Wisconsin Sta. Bul. 323 (1920), pp. 98, figs. 38*).—This contains an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1920. The experimental features not previously reported are for the most part abstracted elsewhere in this issue. A special feature is the insertion in the text of a number of brief general articles.

General index to Colorado Experiment Station publications, compiled by A. DILTS (*Colorado Sta. Bul. 263 (1921), pp. 69*).—This contains a combined subject and author index to Bulletins 1–249, Press Bulletins 1–58, annual reports from 1888 to 1918, inclusive, and three special river bulletins.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul. 6 (1921), No. 3–4, pp. 33–64, figs. 7*).—This number contains several articles abstracted elsewhere in this issue and a brief note on potato diseases.

Monthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul. 9 (1921), No. 2, pp. 17–32, figs. 2*).—This number contains brief articles on the following subjects: Renewing the Lawn, by J. L. Stahl; Production of Silage Corn and Mangels, by M. E. McCollam; Anticipating Pasture Shortage, by H. E. McNatt; Chick Tricks, by Mrs. G. R. Shoup; Intestinal Roundworms in Poultry, W. T. Johnson; and Insect Pests of the Home Garden and Their Control, by A. Frank.

A dictionary of scientific terms, I. F. and W. D. HENDERSON (*London: Oliver and Boyd, 1920, pp. VIII+354*).—This dictionary gives the pronunciation, derivation, and definition of terms in biology, botany, zoology, anatomy, cytology, embryology, and physiology.

Elements of statistics, A. L. BOWLEY (*London: P. S. King & Son, Ltd.; New York: Charles Scribner's Sons, 1920, 4 ed., pp. XI+459, pls. 12, figs. 37*).—Part 1 of the present edition of this standard treatise deals with elementary statistical methods and is based upon similar material in the first edition published in 1901. On the other hand, part 2, Applications of Mathematics to Statistics, is practically a new discussion of frequency curves and the theory of correlation including partial and multiple correlation. Although the illustrative data are taken mainly from the field of economics, the needs of the experimenter are not neglected in the theoretical treatment.

The author believes that an elementary knowledge of infinitesimal calculus is necessary for the serious study of mathematical statistics. "This opinion is confirmed by the very loose reasoning often employed by writers who make too facile use of the standard deviation, of curves of frequency, and especially of the coefficient of correlation. . . . No one should attempt to measure correlation till he has studied the theory closely and critically."

NOTES.

Illinois University.—The legislature has granted appropriations aggregating $10,500,000 for the ensuing biennium. This is a material increase over the present appropriation, which had not been enlarged since 1910, although student enrollment had more than doubled and operating expenses greatly expanded.

Kansas College and Station.—H. B. Walker has been appointed head of the farm engineering department of the college, and has been succeeded as head of the rural engineering department of the extension division by Mark Havenhill. Other appointments include Paul L. Mann as assistant professor of the milling industry and E. S. Lyons, previously instructor in soils, as superintendent of the agronomy farm. G. A. Maxey, assistant professor of dairy husbandry, has resigned.

Louisiana State University.—As the result of action taken by the State constitutional convention, just adjourned, the university will receive $7,500,000 for new buildings and equipment. This sum has been set apart for the purpose from funds accruing from the newly established severance tax on oil and other natural resources. Plans are under way for the erection of the new buildings on a 2,000-acre tract near Baton Rouge.

The new constitution also provides a one-half mill tax, which it is estimated will yield approximately $1,000.000 per annum for the maintenance of the university.

Missouri Station.—Seven new projects have been started by the station during the past year. These include studies of (1) relation of food consumed to protein and energy retained in the carcass, (2) sunflower seed as a feed for fattening swine, (3) standards of growth for dairy cattle, (4) genetic analysis of maize, (5) morphological classification of the varieties of soy beans, (6) rate of growth of chicks under normal conditions, and (7) distribution of abortion infection in swine by positive reacting immune carriers.

The resignations are noted of T. E. Friedemann and O. E. Pollock as assistants in agricultural chemistry and field crops, respectively. Alva C. Hill has been appointed assistant in field crops.

Rutgers College.—The new horticultural building, a two-story brick structure, was recently dedicated. The principal address was made by F. A. Waugh of the Massachusetts College, who predicted the principal impending developments in horticultural practice as along marketing lines.

President W. H. S. Demarest has been granted a year's leave of absence, to be spent in part in compiling a history of the college.

North Dakota College.—O. A. Barton, formerly State club leader, has been appointed in charge of the poultry department, with Glen McIlroy as assistant.

Oregon College.—H. H. Gibson, professor of vocational and agricultural education in the University of Arizona, has accepted an appointment as head of the department of agricultural education.

Rhode Island Station.—Helena A. M. Tibbetts has resigned as assistant in animal breeding and pathology and has been succeeded by Mary E. Williams, a 1921 graduate of Simmons College. Robert L. Jones, a 1921 graduate of the Massachusetts College, has been appointed assistant in chemistry.

EXPERIMENT STATION RECORD.

VOL. 45. SEPTEMBER, 1921. No. 4.

At no period in the history of the experiment stations have changes come so rapidly in their administrative officers as in the past few years. A year ago it was reported that the directorship of practically half of the experiment stations had changed since 1914. During the current year ten more changes have been added to the list. This is an unusually large quota for a single year, and it includes several directors who have long held a prominent place in the annals of these institutions. The conspicuous character of their service and the change which their retirement makes in the roster of station officers are matters worthy of more than passing notice.

A list which includes such names as Jordan, Thorne, Woods, Duggar, and Rolfs reaches well-nigh back to the beginning of the American stations, and when there are added those of Knight, Harris, and Coulter of the more recent group, it will be evident what a single year has brought about in the station ranks. Three of these men have been associated with the experiment stations since their organization under the Hatch Act thirty-four years ago, and two were almost the last connecting link between the original State stations and the national system which grew out of them. Two others had been in the station work nearly or quite thirty years, while two more had served the stations for fourteen and seventeen years respectively.

The States affected by these changes are Alabama, Florida, Maine, Minnesota, New York, Ohio, Oklahoma, Utah, and West Virginia, together with the Virgin Islands. The directors involved in these changes will not in all cases be permanently lost to the interests of agricultural inquiry. Dean Thatcher, for instance, who left the Minnesota Station, has gone to the New York State Station to give his entire time to research. Others, although they have relinquished administrative positions, have not retired and are likely to join the forces elsewhere. While changes in the administrative force are to some extent inevitable with the passage of years, when they result from political or other unfavorable conditions they indicate that the stability of these high positions is not yet fully assured in all cases.

We are apt to give little thought to the beginning of things, and sometimes fail to realize the conditions through which the stations have come up to their present stage of development. We may easily overlook the large extent to which this development is the result of the vision and the influence of certain long-time leaders who have sought diligently to promote the ideals and work out the mission of the experiment stations, in a national sense as well as in their individual States.

As man is the fundamental factor in research, so he has been in developing this new type of institution on American soil, adapting it to its environment without sacrificing the essentials of its general character. Each State has in a sense been a problem in itself, but the example of certain ones and the wise counsel of prominent individuals has been a very large factor in leavening the whole and establishing definite policies. It is well to remember, therefore, the service of those whose influence has been large in realizing the high conception and the destiny of the American stations. To that end the conspicuous list of the year may be passed in review.

Prof. J. F. Duggar of Alabama began his station connection in 1890, as assistant director in South Carolina. He was for three years in editorial work on *Experiment Station Record*, then became agronomist at the Alabama Station, and director in 1903, holding that position for eighteen years. A thorough student and scholar of science, his inclinations were strong in the direction of research having a special bearing on crop production in the Southern States. In his devotion to the interests of that section and his clear vision of the ways and means for improvement, he never lost sight of the ultimate practical aim of experimentation, however technical it might be. He worked to such good purpose that he gained for himself recognition as one of the foremost agricultural authorities in the South, and a leading expert in the field of agronomy. He has been a resourceful and untiring worker who put his best into his work and never shirked responsibility. He has been strong in the councils of his State and in those of the southern stations as a whole.

Prof. P. H. Rolfs, with two short interruptions, had been connected with station work since 1891, and director of the Florida Station for fifteen years. These years marked a period of decided change and development in that station. Its work was systematized and directed along the channels of certain leading industries, and won much support and commendation. While Prof. Rolfs has severed his association with experimental work in this country, our loss will be the gain of a neighboring State in Brazil, where his experience and ability will be relied upon in establishing an institution for agriculture along American lines.

When the experiment station work in Connecticut was reorganized under the Hatch Act, Dr. C. D. Woods became chemist and vice-director of the Storrs Station, then in charge of Prof. W. O. Atwater. He took an important part in the investigations which the latter conducted, notably in human nutrition and the relation of legumes to nitrogen assimilation from the air. In the directorship of the Maine Station, dating from 1896, he followed one who had secured for himself and the station a high degree of confidence and recognition. These he was able to maintain and to develop the station work on sound fundamental lines. He believed in the power of research to supply the practical means of advance, and he sought to do the things that would endure. To that end he built up a corps of able investigators whom he stimulated and protected in holding to their problems. This, with the opportunity he sought for them and the large freedom of initiative he encouraged, placed the activities of the Maine Station on an unusually high plane and gave it a nation-wide reputation. His sudden removal after nearly a quarter century of service, at a time when he was seeking to provide for a line of study whose interruption had been threatened, is one of the tragedies of station administration from which it was hoped the system had become free.

Dr. H. G. Knight began station work in Wyoming in 1904 and had held the position of director since 1910, going to Oklahoma in 1918. His standards and his administrative ability enabled him to place the work of the latter station in a much stronger position. His work there was interrupted by his resignation, which, although voluntary, was due to unfortunate conditions which have frequently befallen that institution.

Dr. F. S. Harris had been for fourteen years in the station work in Utah, and for the past five years its director. He brought to his work sound scientific training and clear conceptions of the necessity for thoroughgoing inquiry as a safe basis for generalization. He left the station to accept the larger administrative position of president of the Brigham Young University.

Dr. John L. Coulter, an economist and the first of his specialty to head a station, had been dean and director in West Virginia since 1915. He leaves to become president of the Agricultural College in North Dakota.

When the United States took over the Virgin Islands, it found an experiment station on the island of St. Croix which had been established in 1910 under Danish auspices. It was organized by Dr. Longfield Smith, a graduate of the Universities of Edinburgh and Leipzig, who had been connected with the Department of Agriculture in Barbados, and he had remained at the head of the station from the time of its establishment. He was continued until the

past summer, when at his own request he retired to engage in citrus growing in Florida.

A conspicuous figure in the Association of American Agricultural Colleges and Experiment Stations for many years has been the Director of the Ohio Experiment Station. This has been due to the man himself and to the prominence of the institution he represented, which was the first station to be established in the Central West. He was appointed director of the station in 1887, and had served continuously in that capacity for thirty-three years. He had previously been manager of the State university farm, where experimental work was carried on, but for several years prior to his appointment as director he had been engaged in agricultural journalism. It is interesting to recall that Prof. Thorne was present at the first meeting of representatives of the agricultural colleges and experiment stations at Washington in 1885, at which, as he has told us in his address as president of the association which grew out of that assembly, chief attention was given to the Cullen bill for a national system of experiment stations. Although that bill did not pass, the essentials of it, with minor changes, became the Hatch Act of 1887. The first convention of the Association of American Agricultural Colleges and Experiment Stations was held in that year, with attention naturally centering in the new measure. The only record of this first convention we owe to the notes which Prof. Thorne took and preserved as secretary. As he has pointed out, the Association was called into being by the movement for a national system of experiment stations, and gave its early attention to inaugurating and directing a new enterprise in the world.

Up to the time of the passage of the Hatch Act the Ohio Station had received about $5,000 a year. For the current year its appropriation is approximately $300,000, the largest of any of the stations. Its remarkable growth is a product of the constructive planning and leadership of its director, supported by a confident and appreciative Commonwealth.

It was through Prof. Thorne's initiative that the station was moved from the grounds of the University to a location where it could have adequate and permanent provision of land, and it was under his immediate supervision that the extensive series of field plats was laid out which has made the Ohio Station one of the leading exponents of plat experimentation.

Although he had not had opportunity for that broad and severe college training we now associate with the preparation of the investigator, Prof. Thorne has evidenced a true scientific mind, because his has been a truth-loving and a truth-seeking mind. To a large extent he may be said to be self-made in his knowledge and in his appreciation and understanding of science. Through all the

years he has labored diligently for the unbiased truth that he might know it. He has been close to agricultural practice and anxious to give it material aid, but he has sought first of all the facts and their meaning, that he might have wisdom in their interpretation into practice. The breadth and liberality of his view is indicated by the development of his organization, building department upon department as the need for it became evident in working out the group of problems to which the station has addressed itself. The standards he has held up for himself and his staff have shown how deeply he was imbued with the spirit of science.

Despite the heavy burden of administrative responsibility resting upon him, Prof. Thorne has carried a remarkable amount of investigation in the field of soil fertility. For some time he has sought relief in retirement from the directorship in order that he might devote himself wholly to garnering in the product of these investigations, a request which was at length granted him last spring. This is a happy outcome, for no one is so well fitted as he to digest these findings and bring to light their teachings in the realm of fact and method.

Two quotations from Prof. Thorne's address as president of the Association of American Agricultural Colleges and Experiment Stations in 1916 illustrate the vision and purpose which have guided him in his thirty-three years of directorship. He said: "The agricultural experiment station is a necessary and indispensable complement to the college of agriculture, for the experiment station is both the crucible in which theories are tested and the fine gold of truth is separated from the dross of error, and the instrument of research by which further progress is made into the realm of the unknown." And again: "Science can not stand still. Each extension of the horizon of our knowledge only expands the boundary of the unknown, and makes yet more imperative the necessity for further research, and the institution which contents itself with present knowledge will soon find itself forgotten. . . . After all is said, it is to the soil and its secrets that we must turn for the material progress of the race; and when material progress ends the intellect will also stagnate."

Dr. W. H. Jordan, who retired in June, was one of the few remaining pioneers among the station directors who aided in founding and building the American system of agricultural research. He was the last of the group who bind the original State stations with the present national system.

The Maine fertilizer control and agricultural experiment station was established in March, 1885, and Dr. Jordan, a native son, was

called to be director and chemist. At that time he was professor of agricultural chemistry in the Pennsylvania State College, and had laid out there the system of plat experiments with fertilizers which has been continued ever since without interruption, the present season concluding forty years. At the time the Maine Station was established there were only nine stations organized and in operation under definite State appropriations, although experimental work was carried on at a number of other colleges.

It was the day of small things, for most of the State stations had only a few thousand dollars appropriation in addition to the fertilizer funds and the sales of products. Dr. Jordan started his career as a station director with an appropriation of $5,000 a year, out of which the fertilizer control had to be maintained. He was, as he has said, his own stenographer, clerk, bookkeeper, and editor, as well as sharing in the analytical work of the laboratory. But in spite of this small beginning he made so strong an impression that he became one of the recognized leaders, and after eleven years was called to the directorship of the foremost station of the country in point of revenue, which had a high record of attainment. The appropriation of the New York State Station at that time was about $80,000, an amount which was more than doubled during his twenty-five years of administration. Although the beginning was so meagre, when Dr. Jordan retired after thirty-six years of directorship in these two stations, he left an institution which while holding true to its function had grown to an annual appropriation of more than $160,000 and a staff of some forty people.

The period of his activity covers the greatest period of development in the American stations, not only in point of revenue but in the growth of agricultural research. He stood consistently through the formative period of the stations for the high ideals and purposes which these institutions were to express. His voice was heard in no uncertain terms in setting forth these ideals, in defining the nature and essentials of research, in criticism of tendencies he believed to be injurious, and in constructive suggestion.

From the first, Dr. Jordan had a clear vision of the field and function of the experiment station as an institution for acquiring information through experiment and research. He contended that the Hatch Act established it "as a means of experimentation and research, and for no other purpose;" that to maintain otherwise was to distort the understanding of an experiment station and the idea fundamental to its organization as expressed in the word "experiment"; and that a station functioning chiefly as an instrument of popular instruction was an absurdity.

He was the champion of a strong organization for the stations, maintaining that although connected with an agricultural college

the station should have a well-defined and independent individuality, that it was never intended that it should be in any sense an appendix to class room instruction, and that the director and leading members of the staff should be first of all workers for the station and give to its proper activities their highest thought and their best energies.

Speaking at the quarter-centennial of the establishment of the first station, in Connecticut, he made this strong appeal for the station director: "Above all, I plead for a station director who is that and nothing more. In the multitudinous duties of administration, in the broad relations which he should sustain with the agriculture of the State, in deciding upon the most useful lines of work, in the sympathetic attitude of encouragement, and if possible of inspiration, which he should maintain toward his associates, there is abundant opportunity for the full exercise of the largest ability and the most untiring energy. If there is any official in our land grant colleges other than the president who should not be halved, it is the station director."

With his understanding of the requirements of substantial investigation he likewise set forth the objection to dividing the time of station men to the extent common. He pleaded for the defense of the investigator in the uninterrupted use of his time on his problems, declaring that "in so far as the energies of this agency are devoted to efforts other than those of research, we are delaying the progress of agricultural knowledge." He maintained that "it is out of the question for college professors to be tied to the daily duties of instructing students and at the same time maintain a close, well informed, and broadly helpful relation to the needs and conditions of agricultural practice;" and again that "we face this fundamental and imperative fact, that a member of a station staff can not be an efficient investigator and engage to any considerable extent in popular instruction."

Since knowledge is a limiting factor in all human endeavor, and it is the primary function of the station to acquire that knowledge essential to agriculture, he made many an ardent plea for opportunity to do its work, and for protection of the station from demands which were outside its proper field. On more than one occasion he called attention to the distortion of the stations' function, the extent to which they had been "coerced in efforts that do not belong to them," and declared that "the greatest and most permanent acquisitions that have come to agriculture as an art during the past fifty years are the outcome of profound scientific study." Again, he explained that "agricultural practice has no greater need to-day than an enlarged vision through more and safer knowledge, and that a new truth may have vastly greater value than many volumes of pleasing addresses." It was an apt illustration of his in referring to

the application of scientific facts that "it is easier to cut a diamond to its setting than it is to find it."

Dr. Jordan has helped us to understand what science is and what it is not, what the essentials are of scientific inquiry, and the distinction between research worthy of the name and other types of work. While admitting that purely practical and local experiments had brought farmers into sympathy with science as a means of progress, he drew the conclusion that "we should guard against centering an experiment around facts or conditions which are of mere local or temporary importance;" and he added that the literature was "already cluttered with so-called practical conclusions that in a brief time will be swept into the rubbish corner." He held it as fundamental to the largest success that experiments should "deal with matters of general and permanent utility;" and he reminded his hearers that the "contributions of note which have entered into the warp and woof of agricultural practice are those which have been proclaimed from the inner temple of science," and furthermore that "the discoveries of scientific truth which are to-day blessing the farmer in his daily toil are mostly those which have been reached through the severest and most searching investigations."

As a basic principle he contended that "the only way to uplift any industry is to develop among those who are engaged in it not only technical knowledge and skill, but intellectual and moral force." This led to his emphasis of the need of the farmer for understanding, and the need for developing not only the bare facts but the meaning of them, their purport, their relationships, in order to be intelligent about them. For he laid great stress on making the farmer independent in his thinking, freeing him from rules and blind formulas, and inculcating the ability to interpret results himself for his particular conditions.

Perhaps it was in the field of criticism that some of Dr. Jordan's most useful work was done. He preserved the attitude of scientific criticism toward his own work and that of his associates, for he sought sound truth and abhorred superficiality or hasty conclusions. He demanded the truth and he did not hesitate to question conclusions where the evidence was defective. His clear analysis of problems and the requirements for their solution was most helpful.

His frank exposure of what he conceived to be weaknesses in the stations, his vigorous comments on conditions and practices which ought to give way to higher standards, were made in no spirit of censoriousness but with a directness that expressed the force of his convictions. They came with a full understanding of the difficulties under which many of the institutions labored, but with no disposition to condone. He looked for progress, and he urged constant pressure in that direction, reminding his co-workers that in this most am-

bitious and extensive scientific effort of the day their ideals, intelligence, integrity of thought and ability, in things scientific, would be judged by the outcome of their labors.

To a considerable extent we have lacked in our agricultural work criticism which has been deliberate and searching, and tempered by the spirit of understanding. The freedom he exercised in that field was one of the large elements of his influence. But it sometimes brought on him the charge of being extreme and idealistic, of advocating ideals not practicable for the time and the place. On one occasion he anticipated such an objection by remarking that if the specifications he had outlined were unattainable "so much the worse for the prospect of scientific progress among us"; and he aptly added that when the temperature essential to the hatching of eggs in an incubator is unattainable the eggs do not hatch.

The influence of such a vigorous, clear-visioned character in the councils of the experiment stations for a period of thirty-six years can hardly be overestimated. It is apparent only after a review of the things he contended for and the course which development has taken. He has been a leader in the march of progress. He will be greatly missed in the meetings of the Association and in his personal relations with those engaged in agricultural research. All who have known him will join in the feeling expressed in the resolutions of the faculty of the Cornell College of Agriculture, that "he has richly earned the relief which retirement from active service brings," and will "wish him many years in which to enjoy the privileges of the contemplative life."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Treatise on general and industrial organic chemistry, I, E. MOLINARI, trans. by T. H. POPE (*Philadelphia: P. Blackiston's Son & Co., 1921, 3. ed., rev. and enl., pp. XV+456, figs. 253*).—This is a translation of the third Italian edition of this treatise, supplanting the translation of the second edition previously noted (E. S. R., 30, p. 309).

The chemistry of agriculture, C. W. STODDART (*Philadelphia: Lea & Febiger, 1921, 2. ed., rev., pp. X+17–340, pl. 1, figs. 83*).—In preparing the second edition of this text on general agricultural chemistry (E. S. R., 32, p. 501), the summary at the end of each chapter has been replaced by a list of suggestive questions by M. W. Lisse on the subject matter of the chapter. New sections have been added on fertilizer materials showing the development of the potash resources of the country and of synthetic nitrogenous fertilizers, and the subject matter in general has been thoroughly revised.

Industrial and agricultural chemistry in the British West Indies, with some account of the work of Sir Francis Watts, Imperial Commissioner of Agriculture, C. A. BROWNE (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 78–83, figs. 4*).—This article continues the report of the author's visit to the British Colonies of tropical America (E. S. R., 41, p. 501). The industries discussed are sugar and cane sirup manufacture, cacao, citric acid, essential oils, and rubber. A tribute is paid to Sir Francis Watts, Imperial Commissioner of Agriculture for the British West Indies, to whom the introduction of modern methods of sugar manufacture and improvement in other agricultural industries are ascribed.

The thermal decomposition of gaseous nitrogen pentoxid.—A monomolecular reaction, F. DANIELS and E. H. JOHNSTON (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 53–71, figs. 5*).

The photochemical decomposition of nitrogen pentoxid, F. DANIELS and E. H. JOHNSTON (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 72–81*).

The polysaccharids, H. PRINGSHEIM (*Die Polysaccharide. Berlin: Julius Springer, 1919, pp. V+108*).—This monograph deals largely with cellulose chemistry in relation to soils and to the recent developments in connection with the manufacture of substitute feeding stuffs. References to the original literature and tables of analytical data on the composition of straw and cellulose products hydrolyzed by different methods are included. The book also contain chapters on starch, glycogen, dextrin, inulin, hemicelluloses, and nitrogen-containing polysaccharids.

The preparation of rhamnose, C. F. WALTON, JR. (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 127–131*).—A method devised at the Bureau of Chemistry, U. S. Department of Agriculture, for preparing rhamnose from flavin, a commercial product rich in quercitrin, is summarized as follows:

"The flavin is hydrolyzed by boiling for 30 minutes with 10 parts of water and 0.5 per cent sulphuric acid. The residue is washed free from sugar and the combined filtrates are neutralized with barium carbonate, decolorized,

and concentrated under diminished pressure to a density of about 40 per cent solids. The inorganic impurities are now precipitated by the addition of ethyl alcohol, and the crystallization is readily accomplished by concentrating the filtrate to a density of 70 to 80 per cent solids. The yield of rhamnose is 20 to 25 per cent of the weight of flavin taken."

The production of volatile fatty acids by bacteria of the dysentery group, H. F. Zoller and W. M. Clark (*Jour. Gen. Physiol., 3 (1921), No. 3, pp. 325–330, fig. 1*).—In the course of an investigation at the research laboratories of the Dairy Division, U. S. Department of Agriculture, of the bacteria of the dysentery group, determinations were made of the volatile fatty acids produced by these bacteria under different conditions. The results of the study are summarized as follows:

. "A close agreement exists among all the organisms studied in the total quantity of volatile fatty acids produced and in the ratio of formic to acetic, under aerobic conditions and in the presence of 1 per cent of glucose. When grown upon peptone alone, with free access of air to the cultures, volatile fatty acids are produced in appreciable quantities, although the reaction of the solution has gone more alkaline as shown by colorimetric pH tests. Formic acid is not found, but in its place we obtain propionic acid.

"Upon exhaustion of air from the nonsugar medium the bacteria again produce formic acid, and in addition some butyric. This is true for both Shiga and non-Shiga cultures. The reaction is distinctly more acid. The presence of glucose in the medium from which the air has been pumped furnishes a condition which provokes about the same type and degree of fermentation that operates in the glucose medium bathed in air at atmospheric pressure.

"The enormous quantity of formic acid produced by these bacteria may play a significant part in the digestive disturbances and toxic symptoms accompanying their infection of the human intestinal tract."

An analysis of otoba butter, W. F. Baughman, G. S. Jamieson, and D. H. Brauns (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 199–204*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of an analysis of the fat expressed from the fruit of *Myristica otoba* and variously known as otoba butter, American nutmeg butter, American mace butter, and otoba wax.

The fat, which has long been used in Colombia, South America, as a medicament for skin diseases of domestic animals, is said to be a white butter-like substance with a nutmeg-like odor in the fresh state, while on standing a brown color and disagreeable odor develop. Chemical analysis showed it to be a mixture of a volatile or essential oil, a fixed oil, and unsaponifiable matter apportioned as follows: Glycerids of lauric acid 15.1, myristic acid 52.2, palmitic acid 0.2, and oleic acid 3.9 per cent; essential oil, chiefly sesquiterpenes, 9.3 per cent; and unsaponifiable constituents, consisting of otobite and iso-otobite ($C_{20}H_{20}O_4$) 9.4 and a viscous mass 11 per cent.

The chemistry of vitamins, A. Seidell (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 72–75*).—In this lecture, delivered before the Chemical Society of Washington, D. C., the author reviews the experimental work on the chemical nature of vitamin B, or the antineuritic water-soluble vitamin, and discusses the probable nature of vitamin activity, particularly from the point of view of similarity in action of vitamins and enzyms.

Colorimetric studies of tryptophan (*Biochem. Ztschr., 109 (1920), pp. 103–164*).—Three papers are presented.

I. *The tryptophan content of blood serum and milk,* O. Fürth and E. Nobel (pp. 103–123).—In this paper the authors review briefly the literature on

tryptophan determinations, and report the results of an application of the method of Voisenet[1] to the determination of tryptophan in blood serum and in human and cow's milk. The technique of the method is as follows:

Two cc. of a standard 0.1 per cent solution of pure tryptophan in 2 per cent sodium fluorid is measured into a 25 cc. graduate, 1 drop of 2.5 per cent formaldehyde solution and, after shaking, 15 cc. of concentrated HCl are added and the whole mixed by pouring into another graduate, after which 10 drops of 0.05 per cent solution of sodium nitrite and sufficient concentrated HCl are added to make the volume up to 20 cc. After mixing by pouring back and forth from one graduate to another and allowing to stand for 5 or 10 minutes, the solution is compared in a Duboscq colorimeter with a solution of the protein to be examined which has been treated in the same manner. In case the tryptophan content is entirely unknown the nitrite solution should be added drop by drop until the maximum color is produced.

As determined by this method, normal horse serum was found to have a tryptophan content of from 0.2 to 0.4 per cent. On fractionation of the serum into globulin and albumin, the serum was found to contain from 1.2 to 1.5 per cent of tryptophan and the globulin from 4.1 to 4.7 per cent. The casein of cow's milk and the protein of the whey after souring each furnished about 2 per cent of tryptophan. The protein of human milk contained from 3.4 to 6.8 per cent. This higher content of tryptophan in human milk is suggested as accounting in part for its more favorable growth-promoting character.

II. *Methodical investigation of the colorimetric tryptophan determination with the Voisenet reaction, together with its application to proteins and organs*, O. Fürth and F. Lieben (pp. 124–152).—This paper reports in detail the systematic study of the Voisenet reaction leading to the development of the technique noted above.

The reaction is sensitive to 1:50,000 tryptophan, and is considered specific for tryptophan except that indol yields a somewhat similar color change. A 0.01 per cent alcohol-water solution of gentian violet is recommended as a fairly good permanent standard for comparison. Difficultly soluble and coagulated proteins should be brought into solution in 20 to 30 per cent sodium hydroxid before making the test.

The tryptophan content of various proteins, as determined by this method, is given as follows: Fibrin 5.3 per cent, Witte's peptone 5.3, serum globulin 4, serum albumin 1.3, human milk protein 6.3, casein from cow's milk 2, keratin 1.2, and egg albumin, edestin, and muscle protein from 2 to 3.5 per cent. The tryptophan content of normal human organs lay between 0.1 and 0.6 per cent. The liver, spleen, and thyroid gland were especially rich and the urine especially poor in tryptophan.

III. *The splitting-off of tryptophan during the digestive process*, O. Fürth and F. Lieben (pp. 153–164).—The method described above was utilized to determine the extent of tryptophan formation from proteins during artificial digestion, the free tryptophan being separated from the bound by precipitation with phosphotungstic acid. On digestion of fibrin with trypsin with careful regulation of the H-ion concentration by means of phosphate, acetate, or borate buffers, not more than one-third or at the most two-thirds of the tryptophan was split off in the course of a week. The authors conclude that there is no ground for assuming that tryptophan, like tyrosin, is liberated from the protein in the early phases of digestion, but that it is given off gradually like the other amino acids.

[1] Bul. Soc. Chim. Paris, 3. ser., 33 (1905), pp. 1198–1214.

The determination of tryptophan in proteins, P. THOMAS (*Ann. Inst. Pasteur, 34 (1920), No. 10, pp. 701–708*).—The author discusses various methods for determining tryptophan in proteins, and describes a modification of a method by Herzfeld [2] which depends upon the blue color formed by the action on tryptophan by *p*-dimethylaminobenzaldehyde in the presence of hydrochloric acid.

In the modified technique 0.4 gm. of the very finely divided product is dissolved in 200 cc. of 0.5 per cent Na_2CO_3 and to this is added 0.1 gm. of active pancreatin, 5 cc. of chloroform, and 5 cc. of toluene. After incubating the mixture at 37° C. for 5 or 6 days, 50 cc. of the solution is removed and treated with 10 cc. of a reagent made by dissolving 20 gm. of *p*-dimethylaminobenzaldehyde in 500 cc. concentrated HCl and 500 cc. of water, and the whole diluted to 100 cc. with concentrated HCl. After standing in the light for 48 hours, the color is compared with that developed in a standard of pure tryptophan similarly treated and a second comparison made at the end of 58 to 60 hours.

The content of tryptophan in casein as determined by this method was found to be from 1.7 to 1.8 per cent.

The determination of H-ion concentration by the colorimetric method and an apparatus for rapid and accurate work, E. VAN ALSTINE (*Soil Sci., 10 (1920), No. 6, pp. 467–478, pl. 1, figs. 2*).—The author describes a color comparator for H-ion concentration determinations by the indicator method, which is said to have been in satisfactory use at the New Jersey Experiment Stations for more than a year in the rapid determination of H-ion concentrations ranging in pH values from 2 to 9.

The apparatus, which is adapted for use with the double tube standard suggested by Barnett and Chapman (E. S. R., 39, p. 9) and improved by Gillespie (E. S. R., 43, pp. 11, 211), consists of an eyepiece supported in a frame so constructed that wooden blocks holding the color tubes can be made to slide in it before the eyepiece, bringing the color tubes successively into view. One block holding the tubes of standard colors with known pH values is passed before one section on the eyepiece, while another block holding tubes containing solutions of unknown pH values is passed before the other section. If double tube standards are used the blocks are made to accommodate two rows of tubes. The tubes used in the apparatus are screw-cap homeopathic vials about 15 mm. in outside diameter and 46 mm. high, which are used open for the unknown solution and tightly sealed for the standard.

To determine the concentration of indicator to be used in the case of the indicators of the Clark and Lubs series, a graph has been constructed that gives the percentage dissociation of the indicators for different pH values. This graph shows not only the percentage of indicator which is in the form giving the acid and alkaline colors when single-tube standards are used, but also the percentage of total indicator in both tubes of each pair that should be placed in each of the tubes when double tube standards are used and equal amounts of solution and indicator are placed in each tube.

Electric oven for rapid moisture tests, G. L. SPENCER (*Jour. Indus. and Engin. Chem., 13 (1921), No. 1, pp. 70–72*).—The oven described, which was designed for rapid moisture tests in sugar work, is essentially a device for conveying a large volume of heated air through a capsule containing the material to be dried. The capsules are of metal, the bottom being closed with monel metal filter cloth through which the air can pass, but which retains very fine

[2] Biochem. Ztschr., 56 (1913), No. 3, pp. 258]266.

powders. The capsules rest on openings over an annular channel leading to the vacuum pump or steam ejector system and containing a heating element consisting of spiraled resistance wire wound over a core. The system is placed in the oven's drying chamber, thus reducing radiation loss. In series connection with the heating element are a sliding contact rheostat for temperature control and an electric time switch which can be adjusted for the desired drying period.

Comparative tests with the new and old type ovens indicate that the moisture can be as completely removed from raw sugar in the new oven by heating at 105° C. for 20 minutes as in the usual types of electric oven by heating to the same temperature for over 3 hours. In addition to the saving of time there is considered to be less danger of decomposition of the material during desiccation in the new oven. Cane bagasse may be dried in the new oven at from 130° to 140° without appreciable decomposition.

A study of the determination of potassium as the perchlorate, and the separation from sodium, etc., R. L. MORRIS (*Analyst, 45 (1920), No. 535, pp. 349–368; abs. in Chem. Abs., 15 (1921), No. 1, p. 39*).—This is a critical discussion of various modifications of the perchlorate method of determining potassium in the presence of sodium, magnesium, calcium, iron, and aluminum compounds and of citric and tartaric acid.

The procedure adopted as the result of this study is essentially that of Gooch and Blake.[3] The solution of the salt is evaporated with 20 per cent $HClO_4$ to dryness (or to a paste if magnesium compounds, phosphoric acid, or organic acids are present), and the residue is treated with 10 cc. of a wash liquid consisting of 100 cc. of 98 per cent alcohol and 1 cc. of perchloric acid. If sodium is present the mixture is allowed to stand for 15 minutes with occasional stirring and the liquid finally decanted through a weighed Gooch crucible containing asbestos. The beaker containing the residue from the first decantation is placed on top of the air oven until the alcohol is evaporated, after which the residue is dissolved in a minimum amount of boiling water and again evaporated to dryness. The treatment with 10 cc. of wash liquid and decantation is repeated, the residue transferred to the crucible, and a measured volume of wash liquid added from a pipette in small portions to complete the washing. If potassium only is present, the precipitate is rinsed directly into the crucible with a measured quantity of the wash liquid. The crucible is then dried for an hour at 130 to 150° C., cooled for an hour in the desiccator and weighed, after which 2 or 3 cc. more of the wash liquid is passed through the filter and the drying and weighing repeated until successive weighings do not vary by more than 0.1 to 0.2 mg.

Data are included on the results obtained in the development and use of this technique, and a note is appended on details and criticism of the perchloric method as officially prescribed in Great Britain as an alternative for the platinic chlorid method of determining potassium in fertilizers.

New quantitative method for the determination of bromin, G. HARTWICH (*Biochem. Ztschr., 107 (1920), No. 4–6, pp. 202–206; abs. in Chem. Abs., 15 (1921), No. 1, p. 101*).—A method of determining bromin in urine or other organic fluids in which it may occur in minute amounts is described, and data are presented on its reliability. The method is essentially as follows:

The urine, ashed with sodium carbonate, is treated with sulphuric acid until the evolution of CO_2 ceases, after which free chlorin is added in small amounts and the liberated bromin is shaken out with chloroform. Each portion of

[3] Amer. Jour. Sci., 4. ser., 44 (1917), No. 263, pp. 381–386.

chloroform is removed to a watch glass and tested with acid fuchsin, and the extraction is continued until the violet color imparted by the bromin to the chloroform in the presence of fuchsin is no longer obtained. A control of chlorin water and potassium iodid is titrated with N/10 $Na_2S_2O_3$ to determine the titer of the chlorin.

A new apparatus for determining the catalase content of milk, A. MACHENS and F. CORDES (*Milchw. Zentbl., 50 (1921), No. 3, pp. 25–27, fig. 1; also in Ztschr. Fleisch u. Milchhyg., 31 (1921), No. 9, pp. 115–117, fig. 1*).—The apparatus described and illustrated in this paper consists of an ordinary flask or bottle joined near the top by means of a glass tube provided with a three-way stopcock to a second receptacle shaped somewhat like a U tube, one arm of which is approximately the same size and shape as the first flask and the other shorter and of smaller dimensions but extended by means of a 12 or 15 cc. tube graduated in cubic centimeters. In operation 15 cc. of milk is placed in the first flask and sufficient water in the second to bring the level to the zero mark on the graduated tube. The apparatus, open to the air, is placed in the incubator at 37° C. for 15 minutes, after which the stopcock is turned to close the connection between the two flasks. Five cc. of 1 per cent H_2O_2 solution is then added to the milk and the flask corked and shaken, after which the apparatus is again placed in the incubator and the stopcock opened. After the action has ceased, the amount of gas evolved is measured by the height of water in the graduated tube.

Conservation and analysis of milk samples preserved by dichromate, G. HINARD (*Ann. Falsif., 13 (1920), No. 142–143, pp. 463–474*).—This is a detailed discussion of the effect of added dichromate upon various milk determinations, leading to the conclusion that modifications in all the constituents take place after a short time to such an extent as to render the results invalid. Reference is made to the discussion of the same subject in recently noted papers by Marchadier and Goujon (E. R. S., 42, p. 112), Hildt (E. S. R., 43, p. 14), and Magnier de la Source (E. S. R., 44, p. 204).

A butter hydrometer, A. BRUNO (*Ann. Falsif., 13 (1920), No. 144–145, pp. 543–545, fig. 1*).—A novel device for the rapid determination of moisture in butter is described. This consists of a hydrometer surmounted by a small platform on which can be placed a metal cup to contain the butter sample. The hydrometer is so weighted that when placed in a cylinder of distilled water the zero mark of the scale is at the level of the water when the cup resting on the platform carries a weight of 5 gm. In operation sufficient butter is introduced into the cup to bring the zero mark to the level of the water. The cup is next removed and heated over a small flame with careful manipulation until the moisture is driven off as noted by the sudden darkening in color. It is then replaced on the platform and the point to which the hydrometer sinks is read on the scale, which is graduated into 20 divisions each of which corresponds to 1 gm. of water for 100 gm. of butter. No data are given as to the accuracy of the method.

The Bömer method for the detection of suet in lard, VITOUX and C. F. MUTTELET (*Ann. Falsif., 13 (1920), No. 146, pp. 593–601*).—This is the first of a series of studies on the application of the Bömer procedure (E. S. R., 32, p. 801) for detecting the presence of suet in lard by means of the differences in melting point of crystals of the pure glycerids and of the fatty acids obtained from them by saponification. The results obtained are interpreted from the fact that α-palmito distearin, the principal component of lard, melts at 68.5° C., β-palmito distearin, the corresponding component of beef fat, at 63.3°, and the mixture of fatty acids obtained by saponification of the two at 63.2°. For

comparison the expression 2 G—A is used where G=the melting point of the glycerids and A of the fatty acids.

An examination by this method, the technique of which is described in detail, of pure pork fat from different parts of the animal and of commercial lard of French origin, has shown that for all samples the value 2 G—A is equal to or higher than 68. This value is consequently set as the minimum limit for unadulterated lard.

A microdetermination of calcium in blood, serum, and other organic substances, D. J. DE WAARD (*Biochem. Ztschr., 97 (1919), No. 3–5, pp. 176–185, fig. 1*).—The method consists in ashing in a platinum crucible from 0.5 to 1.5 cc. of blood to which a little concentrated hydrochloric acid has been added to facilitate the ashing, dissolving the ash in a few drops of dilute hydrochloric acid, transferring the solution by means of a capillary pipette to special centrifuge tubes, and washing out the pipette with a few drops of the acid. The tube is placed in a boiling water bath and the calcium precipitated as oxalate by means of half saturated ammonium oxalate solution, followed by a little ammonia and then acetic acid until the solution smells strongly of the acid on shaking. After cooling, the precipitate is separated by centrifuging and is then dissolved in about 0.3 cc. of dilute HNO_3, 1 : 1, heating on the water bath at 50° C. The solution is finally titrated with N/100 potassium permanganate, using a burette delivering 0.01 cc. drops and finishing the titration with a capillary pipette.

Direct microcalcium determination in serum, D. J. DE WAARD (*Biochem. Ztschr., 97 (1919), No. 3–5, pp. 186–188*).—Further study of the above method has shown that it is possible to precipitate all of the calcium of blood serum as pure calcium oxalate without previously ashing the serum.

The routine determination of creatinin and acetone in urine, H. J. GOECKEL (*Jour. Lab. and Clin. Med., 6 (1921), No. 6, p. 338*).—A routine clinical test for creatinin and acetone in urine is outlined as follows:

To each of a series of test tubes containing 5 cc. each of urine is added 10 drops of a saturated aqueous solution of sodium nitroprussid, followed by sufficient NaOH solution to produce the maximum intensity of color. A normal or high creatinin content is indicated by a dense cherry red color and a low content by a paler shade of red. On adding glacial acetic acid to each tube the urine returns to its normal color when the creatinin content is low, and to different shades of green, with varying amounts of creatinin, if acetone is absent. If acetone is present, various shades of red are produced.

Notes on the U. S. Government method of determining phenols in sheep dips, K. B. EDWARDS and G. A. FREAK (*Jour. Soc. Chem. Indus., 39 (1920), No. 23, pp. 326T, 327T*).—Attention is called to the method described by Chapin (E. S. R., 20, p. 420) for determining phenols in sheep dips by distilling the acidified dip with steam, dissolving the phenols in benzene, and finally shaking them out in 1 : 3 NaOH and measuring the increase in volume of the alkaline solution. Exception is taken to the assumption that, for mixtures of phenols ordinarily occurring in commercial cresylic acid and in the grades of coal tar creosote oils commonly used in making dips, the average coefficient weight of phenols divided by volume increase of NaOH is unity. Determinations are given of this coefficient for phenols, the three cresols, and cresylic acid fractions boiling at different temperatures.

The results reported show that the coefficient varies with the nature of the phenols, ordinary phenol showing an excess of 8 per cent and *p*-cresol a deficiency of 2.5 per cent. It is pointed out that the use of this method for evalu-

ating cresylic creosotes and cresylic acids bought for sheep dips introduces a serious error, tending to indicate, in the case of cresylic acid having a large percentage of *o*-cresol, a purity from 4 to 6 per cent below its true content of phenols.

Determination of invert sugar in the presence of sucrose by Bruhns' method, P. Beyersdorfer (*Ztschr. Ver. Deut. Zuckerindus., 1920, No. 773, II, pp. 259–271; abs. in Jour. Soc. Chem. Indus., 39 (1920), No. 15, p. 554 A*).—This is a discussion of Bruhns' method of determining invert sugar (E. S. R., 43, p. 314), with a comparison of results obtained on pure sugar and molasses by this and other methods.

An inherent error in certain modifications of the Clerget method of double polarization, C. A. Browne (*La. Planter, 66 (1921), No. 7, p. 109*).—The author discusses the validity of the modification of the Clerget method developed by Jackson and Gillis (E. S. R., 44, p. 413).

The application of the Clerget method to dilute sucrose solutions, R. F. Jackson and C. L. Gillis (*La. Planter, 66 (1921), No. 9, pp. 141, 142; also in Facts About Sugar, 12 (1921), No. 10, pp. 190, 191*).—A reply to the above.

A few observations upon the Clerget modification of neutral polarization, C. A. Browne (*La. Planter, 66 (1921), No. 11, pp. 171, 172, fig. 1; also in Facts About Sugar, 12 (1921), No. 12, pp. 230, 231, 234, fig. 1*).—A further discussion of the Jackson-Gillis modified Clerget method in reply to the above.

Manufacture of sugar cane [sirup] so as to prevent crystallization and fermentation, J. K. Dale and C. S. Hudson (*Fla. Dept. Agr. Bien. Rpt., 16 (1919–20), pt. 1, pp. 204–213, fig. 1*).—A method devised at the Bureau of Chemistry, U. S. Department of Agriculture, for manufacturing sugar cane sirup with a water content of less than 20 per cent and that will not crystallize or ferment on standing is described briefly.

The principle of the method is the transformation of a large part of the crystallizable sucrose into invert sugar by the action of invertase. The cane juice from the mills or clarifiers is first evaporated in any type of evaporator to a density of 20° Baumé, after which the sirup is run into tanks and cooled to 140° F. and the invertase added in the proportion of 3 parts of invertase solution to 100 of the sirup. After standing over night the sirup is again evaporated to a Baumé reading of 36 to 37° in the boiling sirup or 42° after cooling to ordinary temperature.

Chlorin balance during the manufacture of sugar and the content of chlorin in the sugar beet, É. Saillard (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 5, pp. 283, 284*).—Completing the study of the distribution of the various constituents of sugar beets in the products of sugar manufacture (E. S. R., 43, p. 206), data on the chlorin distribution are presented. The average content of chlorin in the beet itself was 0.016 and in the molasses 0.3 per cent. Of the chlorin originally present in the beet 80 per cent passes into the molasses and 19 per cent remains in the diffusion residue, with an undetermined loss of 1 per cent. In the plant itself the content of chlorin was highest (about 1.8 per cent) in the stalks. The entire plant showed an average of about 1.2 gm. of chlorin for 100 gm. of sugar.

Report of committee on manufacture of sugar and utilization of by-products, W. von H. Duker et al. (*Hawaii. Sugar Planters' Assoc., Proc., 39 (1919), pp. 216–240*).—This report consists of an outline of developments and improvements in the manufacture of sugar in Hawaii during 1918–19, as embodied in reports from plantation managers.

The hydrogenation of oils and the manufacture of hydrogenated fats, O. Bänninger (*Schweiz. Chem. Ztg., 1921, No. 1, pp. 1–11*).—The author dis-

cusses the theoretical and practical phases of the manufacture of hydrogenated oils.

Paint bulletin (*North Dakota Sta. Paint Bul., 1 (1919), No. 7, pp. 113–138, figs. 2*).—This special paint bulletin consists of the following papers:

A study of the fatty acids obtained from varnish oils and varnishes, II, W. T Pearce (pp. 113–115).—In continuation of the study previously noted (E. S. R., 39, p. 613), the results are reported of the application of various tests to the fatty acids obtained from varnish oils and varnishes. The iodin number was found to be qualitatively useful for cases where soy bean or cottonseed oil was added to linseed or menhaden oil, but worthless for quantitative estimation. The odor served to detect menhaden oil when present in amounts as large as 20 per cent and China oil to the extent of 40 per cent. The concentrated H_2SO_4 spot test gave a characteristic begonia leaf coloration with pure linseed oil and a yellowish green fluorescence with large amounts of soy bean oil. The hexabromid test gave excellent qualitative and semiquantitative results detecting the presence of menhaden oil in amounts of 10 per cent or above.

The wearing quality and physical tests of several exterior varnishes compared with their chemical analysis, W. T. Pearce and E. V. Ladd (pp. 116–129).—The results are reported of a number of physical tests, chemical analyses, and service tests of several exterior, interior, and floor varnishes. As these studies are to be continued, no definite or final conclusions have as yet been drawn.

Soy bean investigation, C. Ladd (pp. 130–138).—This paper supplements the data on soy bean oil in Bulletin 118 from this station (E. S. R., 36, p. 206) by similar data on the composition of the oil obtained from soy beans of the 1915 and 1916 crops and of crops grown in 1918 from the seeds of 1916, the seeds in many cases being grown in different localities. A change in locality was found in some cases to alter the iodin value of the oil. In general beans giving a certain iodin number in one locality showed a decided increase in iodin number when grown in a colder climate and vice versa. An increase or decrease in iodin value appeared to have no consistent effect on the oil content of the bean, nor did the oil content affect the iodin number.

Glue, gelatin, and their allied products, T. Lambert (*London: Charles Griffin & Co., Ltd., 1920, 2. ed., pp. XII+153, figs. 25*).—Of particular interest in this reference book on the glue and gelatin industry is the chapter on residual products, in which are given the methods of manufacture, composition, and particular use of various fertilizers prepared from skin, fish, and bone residues and from leather waste. The methods of preparing calcium phosphate and bone ash as by-products of the gelatin industry are described.

METEOROLOGY.

Local forecast studies—summer rainfall, T. A. Blair (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 183–190, pls. 2, fig. 1*).—In this article "observations at Dubuque, Iowa, at 7 a. m., ninetieth meridian time, for June and July, for the 20-year period, 1901 to 1920, inclusive, are tabulated with reference to the occurrence of precipitation within the following 12 and 24 hours, and classified according to the following elements: (1) Height of barometer, reduced to sea level, (2) change in height of barometer during past 12 hours, (3) change in temperature during past 24 hours, (4) amount of cloudiness, (5) relative humidity. A further classification according to (1) wind direction, and (2) kind of clouds is based on a 30-year period for the four months, May to August, inclusive.

"The results are shown in a series of tables and curves, based on the relation which the number of observations followed by rain within 12 or 24 hours

bears to the total number of observations within the group. These tables and curves are intended to show the more important relationships existing between the data of the morning observation and the rain frequency during the following 12 and 24 hours, and it is suggested that a series of simple classifications, such as these, could be made at numerous stations throughout the United States, and would furnish material of much value."

The data used in this study showed the total probability of rain in 12 hours, under all conditions, to be 0.31. With a falling barometer the probability was increased about 10 points, except when the barometer was high. In this case it seemed less likely to rain with falling than with rising pressure. With a cloudy sky as well as a falling barometer the chances of rain in 12 hours increased from 20 to 40 points, ranging from 83 per cent with a low barometer to 33 per cent with a high barometer. The least probability of rain was connected with a falling temperature accompanied by clear weather and a rising barometer. There was considerable increase in rain probability with high humidity and a less marked decrease with low humidity.

Seasonal forecasting of precipitation—Pacific coast, A. J. HENRY (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 213–219, figs. 2*).—In this article an effort is made to discover from the available observational material "the true nature of the weather phenomena associated with years of heavy and years of light precipitation on the Pacific coast."

It is stated that the data show clearly that "the distribution of precipitation in Pacific Coast States is not, as a rule, of the same order of intensity. Indeed, fairly heavy precipitation in Washington and Oregon may be associated with deficient rainfall in California, and vice versa. The physical grounds for the difference in distribution are next sought. Three classes of seasonal distribution are distinguished, and these in turn are discussed with reference to their probable causes.

"The conclusion is reached that a knowledge of the pressure distribution over the northeastern portion of the Pacific Ocean and the Canadian Northwest affords the most hopeful avenue of approach to a rational solution of the problem."

The effect of vegetative evaporation on the rate of seasonal temperature changes, R. H. FINCH (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 206–209, fig. 1*).—Data are given in this article which show that "the evaporation of water transpired from vegetation causes a definite local cooling. An attempt to show that vegetative evaporation affects large areas is made by comparing spring average daily temperature curves of continental stations in arid and humid regions. Four figures are given showing a flattening in such curves for the stations in humid regions with less flattening, or none at all, for the stations in arid regions. It is pointed out that several factors, among them the control of weather by 'highs' and 'lows,' tend to obscure departures from a smooth curve caused by vegetative evaporation, but the evidence seems to indicate that vegetative evaporation has an appreciable effect."

The artificial control of weather, N. SHAW (*Abs. in Met. Mag. [London], 56 (1921), No. 663, pp. 60–63; also in U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 244–246*).—The author's general conclusion is that "in the open air the ordinary inexorable laws which control the behavior of the atmosphere . . . have such enormous masses of energy in the form of warmth and water vapor in reserve that our own little reserves are not equal to making any serious impression on the course of nature."

Applied climatology in California, A. H. PALMER (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 219–223*).—The practical applications of California clima-

tology in its relation to agriculture, manufacture, industry, mining, transportation, aviation, conservation, public service, advertising, public health, and recreation are briefly discussed in this article, "in the hope that the survey may be of interest and perhaps of value in other climatological sections, and with a desire that it may inspire similar surveys of other regions." Under agricultural applications are especially considered the relation of climate to sugar-beet growing, production of citrus fruits, date culture, rice culture, cotton growing, and the agricultural possibilities of undeveloped lands.

Nocturnal temperature inversions in Oregon and California, F. D. YOUNG (*U. S. Mo. Weather Rev., 49 (1921), No. 3, pp. 138–148, pls. 2, figs. 14*).—Summarizing this article, the author says that "not enough attention has been paid in the past to locating crops subject to damage by frost on the more frost-free hillsides; and at the present day the phenomenon of nocturnal temperature inversion is not well understood by most fruit growers. Orchards set out 20 years ago in some of the coldest sections in several fruit districts on the Pacific coast are still being operated at a loss, while others have been removed only during the last two or three years. Detailed records of nocturnal temperature differences on slopes, covering entire frost seasons, are scarce.

"Observations of nocturnal temperature inversions, made at Pomona, Calif., and Medford, Oreg., during the frost seasons of 1918, 1919, and 1920, are given in detail and discussed in this paper. Inversions at Pomona during the winter are compared with those at Medford during the spring. Differences in minimum temperature as great as 28° F. were observed between stations at the base and 225 ft. above the base on a hillside at Pomona.

"The greatest inversions occur on clear, calm nights following warm days. The duration of the minimum temperature on the hillside is usually much shorter than on the valley floor below, on account of large fluctuations in temperature during the night on the hillside. On every hill where observations were made the data indicate that on clear, calm nights the top of the hill is colder than points on the hillside some distance below."

Other articles based in part on the same observations have been previously noted (E. S. R., 43, p. 417).

Frost and fruit in southern Ohio in 1917, W. H. ALEXANDER (*U. S. Mo. Weather Rev., 49 (1921), No. 4, pp. 232–234, figs. 3*).—Meteorological conditions contributing to the poor fruit crop in southern Ohio in 1917 are discussed. The author is disposed to attribute a large part, perhaps the major part, of the damage to cool, wet weather during the period of pollination in May.

The freezing of peach buds, E. S. JOHNSON (*Abs. in U. S. Mo. Weather Rev., 49 (1921), No. 4, p. 231*).—From observations at the Maryland Experiment Station on the freezing point of the sap in peach buds, as measured by means of a portable galvanometer and a needle-type thermocouple, the conclusion was reached that "a period of cold weather immediately following a rain is apparently more dangerous to a peach orchard than cold weather alone."

Evaporation and forest fires, E N. MUNNS (*U. S. Mo. Weather Rev., 49 (1921), No. 3, pp. 149–152, figs. 4*).—This paper shows that "the occurrence and spread of large forest fires are coincident with a greatly increased rate of evaporation or a decrease in vapor pressure."

Sixth report of the Committee for the Investigation of Atmospheric Pollution ([*Gt. Brit.*] *Met. Off. Advisory Com. Atmos. Pollution Rpt., 6 (1920), pp. 24, figs. 9; rev. in Science, n. ser., 53 (1921), No. 1373, pp. 389–391; abs. in U. S. Mo. Weather Rev., 49 (1921), No. 3, pp. 159, 160*).—This report covers the year ended March 31, 1920, and follows generally the same lines as the fifth

report, previously noted (E. S. R., 44, p. 209), largely confirming previous conclusions regarding the character and distribution of pollution and the conditions which affect these in urban and rural communities. Particular attention is given to methods of measuring and determining the character of the atmospheric deposits, especially its acidity. It was found impracticable to use the ordinary rain gauge for measuring the deposit because of the corrosive action of the deposits due to acidity. Descriptions and drawings of special apparatus and methods for determining acidity are given.

Monthly Weather Review (*U. S. Mo. Weather Rev., 49 (1921), Nos. 3, pp. 115–181, pls. 18, figs. 26; 4, pp. 183–270, pls. 23, figs. 23*).—In addition to detailed summaries of meteorological, climatological, and seismological data, and weather conditions for March and April, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 3.—Theory and Use of the Periodocrite (illus.), by C. F. Marvin; A Statistical Comparison of Meteorological Data with Data of Random Occurrence, by H. W. Clough; The Mean Variability as a Statistical Coefficient, by E. W. Woolard; The Variate Difference Correlation Method, by E. W. Woolard; Note on Prof. Marvin's Discussion of A Possible Rainfall Period Equal to One-ninth the Sunspot Period, by D. Alter; Dates of the Opening of Oneida Lake, N. Y., 1869–1921, by E. S. Clowes; Registration of the Intensity of Sun and Diffused Sky Radiation (illus.), by A. Ångström and C. Dorno; Nocturnal Temperature Inversions in Oregon and California (illus.), by F. D. Young (see p. 320); Evaporation and Forest Fires (illus.), by E. N. Munns (see p. 320); Forecasting Thunderstorms by Means of Static Electricity, by F. W. Reichelderfer; Naval Meteorology During Seaplane Flights from San Diego to Balboa, by J. C. O'Brien; Another Note in Regard to the Primary Cause of Colds, by C. M. Richter; Note on Some Effects of Weather Changes on Disease, by J. R. Weeks; Weather and Disease, by J. R. Weeks; and Exchange of Wireless Weather Reports by Vessels.

No. 4.—Local Forecast Studies—Summer Rainfall (illus.), by T. A. Blair (see p. 318); The Fire-colored Sunset as a Valuable Clue to the Existence of a Tropical Storm, by R. M. Dole; The "Tablecloth" of Table Mountain (illus.), by C. F. Talman; Thunderstorm Breeding Spots, by R. E. Horton; The Beginning of a Thunderstorm (illus.), by R. E. Horton; Tornadoes of April 15, 1921, in Arkansas and Texas (illus.), by W. C. Hickmon; Local Storms in Mississippi, by R. T. Lindley; The Tornadoes of April 16, 1921, in Alabama, by P. H. Smyth and J. W. Smith; Tornadoes in Tennessee on April 16, 1921 (illus.), by R. M. Williamson; Cyclonic Storm of July 1, 1920, and Its Effect on Pond Elevation at the Dam of the Mississippi Power Co., at Keokuk, Iowa (illus.), by R. H. Bolster; Correlation of Maximum Rain Intensities for Long and Short Time Intervals (illus.), by R. E. Horton; Cloudburst Rainfall at Taborton, N. Y., August 10, 1920 (illus.), by R. E. Horton and G. T. Todd; Correlation of Wind Velocity and Convective Rains at Houston, Tex. (illus.), by I. R. Tannehill; The Effect of Vegetable Evaporation on the Rate of Seasonal Temperature Changes (illus.), by R. H. Finch (see p. 319); Note on Evaporation from Reservoirs; Weather-forecasting Meeting of the National Electric Light Association in San Francisco, by E. A. Beals; Seasonal Forecasting of Precipitation—Pacific Coast (illus.), by A. J. Henry (see p. 319); Applied Climatology in California, by A. H. Palmer (see p. 319); The Approximate Normal Temperature as a Function of the Latitude, Elevation, Time of Day, and Day of the Year (illus.), by F. L. West; True Mean Temperature (illus.),

by C. E. P. Brooks; The Secular Variations of Climate, by J. Paraskévopoulos; Frost and Fruit in Southern Ohio in 1917 (illus.), by W. H. Alexander (see p. 320); Cold Air Prevents Severe Freeze, by A. M. Hamrick; Mapping the Ocean of Air, by C. E. P. Brooks; Progress in Making Free-air Pressure and Wind Charts (illus.), by C. L. Meisinger; Distribution of Weather Information, Forecasts and Warnings by Naval Radio for the Benefit of Aviation and Marine Interests; Lightning Explodes Tree and Digs Trenches (illus.), by A. F. Stevens; and Unusual Lightning, by R. E. Horton.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), Nos. 11, pp. [204], pls. 4, fig. 1; 12, pp. [209], pls. 4, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1920, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander, H. W. Poole, and A. G. Lindskog (*Massachusetts Sta. Met. Buls. 389–390 (1921), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Methods of mechanical soil analysis, D. J. Hissink (*Internatl. Mitt. Bodenk., 11 (1921), No. 1–2, pp. 1–11*).—A critical study on methods of preparing samples of soil for mechanical analysis is reported indicating the marked influence of preparation on the results.

The conclusion is drawn that mechanical methods of preparation, such as grinding, shaking, or boiling, have a pulverizing effect on individual soil particles and should not be used for sand soils. The use of N/5 cold hydrochloric acid for preparation of the soil is considered to be preferable. The so-called colloidal chemical preparation in which the soil after treatment with hydrochloric acid was treated with N/10 ammonia solution was found to dissolve out the free humus acids and to have a digesting action on the clay particles and humus colloids. There was practically no difference in the final results obtained when the preparation was begun on fresh or air-dried soils.

A bibliography is appended.

A comparison of the technic recommended by various authors for quantitative bacteriological analysis of soil, Z. N. Wyant (*Soil Sci., 11 (1921), No. 4, pp. 295–303*).—In a contribution from the Michigan Experiment Station, methods for the quantitative bacteriological analysis of soils used by others are summarized and compared, and the following points suggested as being worthy of attention should the standardization of quantitative bacteriological analytical methods be considered:

"Not less than 10 gm. of soil should be used in making the first dilution. The initial dilution should be not less than 1:10. If the soil contains considerable organic matter, it should be triturated in a mortar with a little of the diluting liquid. In all cases the weighed soil sample should be made up to the volume of the desired initial dilution by the addition of sufficient diluting liquid, e. g., for a 1:10 dilution, 10 gm. of soil should be placed in the graduated flask, cylinder, etc., and sufficient diluting liquid added to bring the volume up to 100 cc. Care should be taken in making further dilutions or in plating to transfer an aliquot of the soil itself as nearly as possible. The second dilution should contain not less than one-tenth of the amount of soil

in the first dilution. Noyes and Voigt's recommendation may well be followed in making succeeding dilutions, i. e., each higher bacterial dilution should be made by taking 10 cc. of the lower bacterial dilution and 90 cc. of the diluting liquid. Numbers of microorganisms (total or otherwise) should be estimated on the basis of soil oven-dried at 100° C. to a constant weight."

The adsorptive appearances in soil. Method for determination of the exchangeable or adsorptively combined bases in soil and their importance for the soil processes, D. J. Hissink (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 24 (1920), pp. 144–248*).—A number of studies are reported which led to the conclusion that bases are present in both mineral and organic soil complexes, which, when the soil is treated with a solution of one of these bases, are very rapidly exchanged with the base of the solution. Soil contains aluminum silicates and so-called humates, the bases of which are exchangeable. On the other hand, bases are present in both clay and humus which are practically not exchangeable. A part of such bases go into solution when the soil is treated with hot, strong hydrochloric acid. Such bases are therefore characterized as acid-soluble bases. It was further found that in normal clay and humus lime is the predominating exchangeable base.

However, it is concluded that lime is not less firmly combined in soil than potash, but that there are two forms of aluminum silicate and humate, the bases of which are either exchangeable or not exchangeable with the ammonia of ammonium chlorid. The further conclusion is drawn that the exchangeable bases exist in the spaces between the solid particles or solid phase of soil and the soil solution or liquid phase and are considered to be in adsorbed condition.

The amount of unfree water in soils at different moisture contents, G. Bouyoucos (*Soil Sci., 11 (1921), No. 4, pp. 255–259*).—Studies conducted at the Michigan Experiment Station are reported which showed that the amount of water which soils are able to render unfree does not vary with the different moisture contents, but appears to remain constant. This is considered to be of much importance, especially in relation to the availability of moisture in soils at different moisture contents, the possible behavior of soils toward fertilizers, and the physical condition of the soil.

Carbon dioxid in soil air, J. Sen (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 41–43*).—Periodical determinations of the carbon-dioxid content of the soil air of a grassed plat, a grassed plat partly aerated by trenches, and a surface-cultivated plat showed that the percentage of carbon dioxid in the soil air was highest in the grassed plat and lowest in the cultivated plat. The variations in the carbon-dioxid content were greatest in the grassed plat and smallest in the cultivated plat.

Soil acidity and a field method for its measurement, E. T. Wherry (*Ecology, 1 (1920), No. 3, pp. 160–173, pl. 1*).—A detailed discussion of the nature of soil acidity is given, and the conclusion is drawn that it can best be explained on the basis of the presence of hydrogen ion. Soil colloids are discussed in this connection, and it is stated that the more colloidal material a soil contains the greater will be the acidifying effect of adding a neutral salt.

The author approves of the Veitch method for determining the lime requirement of the soil and is of the opinion that the quantity of acid present in a soil is far less significant than the hydrogen-ion concentration or specific acidity when effect upon the growth of plants is under consideration. In this connection a field method for determining specific soil acidity by comparing indicator colors is described.

The cause of the acidity of soils made acid by exchange of ions, H. KAPPEN (*Landw. Vers. Sta., 89 (1916), No. 1, pp. 39–80*).—Studies of different mineral soils under a covering of raw humus showed that they possessed all the characteristics of acidity resulting from an exchange of ions. Therefore the exchange acidity of such soils is attributed to the action of the acid humus solution filtering down from the raw humus covering. The condition of exchange acidity was produced in neutral mineral soils by treatment with raw humus solution. The decomposition of neutral salts by raw humus was similar to its action on mineral soils; the aluminum or iron ions of the raw humus were exchanged for the metal ions of the neutral salt solution.

It was shown that many of the plants making up the raw humus were capable of causing an exchange of trivalent ions in their fresh state, and that humification of these plants does not cause this ability. The exchange acidity of raw humus produced no evident increase in the true acidity of humus solutions.

Hydrogen-ion concentration in extracts of moor soils and of plants forming moors and raw humus, H. KAPPEN and M. ZAPFE (*Landw. Vers. Sta., 90 (1917), No. 5–6, pp. 321–374*).—In continuation of the work noted above, studies were conducted of the conditions of acidity in a series of samples of upland moor soils taken from cultivated and uncultivated and fertilized and unfertilized fields. Studies were also made of fresh undecomposed sphagnum moss and of plants from which the greater part of so-called raw humus is formed.

Digestion and seepage experiments were conducted, the former with water, normal potassium chlorid solution, and a 10 per cent solution of calcium acetate and the latter with water and potassium chlorid solution. It was found that in contrast to the digestion experiments, the seepage experiments produced solutions which possessed an important so-called titration acidity and also considerable true acidity. The water extract of the cultivated moor soil was characterized by a very low hydrogen-ion concentration in contrast to the uncultivated moor soils, indicating the influence of cultivation and liming in reducing acidity. The strong degree of disassociation of acids in the water extract of the uncultivated soils is thought to indicate the presence of strong acids such as sulphuric acid, and there was no indication of the presence of so-called humus acids.

The seepage experiments with potassium chlorid increased the true acidity and the acidity of titration in all soils. The cultivated soils again showed the lowest hydrogen-ion concentration. It is concluded that the aluminum chlorid produced in solution by exchange of ions after treatment with potassium chlorid solution is not the sole cause of the acidity of the solution. Quantitative determination of the sesquioxids in the solution showed that generally only a fraction of the aluminum estimated by titration could be precipitated from the solution. There was no equilibrium between the alkali used and the aluminum chlorid present in solution. This is explained on the basis of the absorption of part of the aluminum by the moor soil materials. In spite of the evident errors, the so-callled neutral salt decomposition is considered to be due to exchange of ions. When moor soil which had been treated with potassium chlorid solution was washed out with water a dark brown humus solution of neutral reaction was produced, and the residue gave an acid reaction with litmus paper and calcium acetate.

In the studies of plant materials, it was found that the hydrogen-ion concentration of the water extract of most of the plants studied was such as to exceed the change point indicated by litmus. The results indicate the presence

of acids in plants, and that plant matter does exercise a true acid action. The observed increase in titration acidity resulting from the action on many plants of neutral salts, such as potassium chlorid, was not accompanied by a corresponding increase in hydrogen-ion concentration. The appearance of iron and aluminum in the solution after treatment of the fresh plant with potassium chlorid solution is considered to be the result of an exchange of ions.

Investigation of soil and peat residue samples from polders and lakes in connection with plans for drainage. The chemical composition of flat moor soils, D. J. Hissink (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 24 (1920), pp. 13–143, figs. 3*).—A report is presented of studies of the physical and chemical properties of the soils of polder and lake beds in swamp areas in the neighborhood of Utrecht in Holland, which it is proposed to reclaim by drainage.

These so-called "Baggererde" and "Legakkerböden were compared with moor soils of known composition and productivities. It was found that they are sufficiently supplied with plant nutrients with the exception of potash and possibly of phosphoric acid, and that the organic matter in the Baggererde or peaty residue over diluvial sand is in a sufficiently advanced stage of decomposition and humification.

It was also found that the injurious sulphur compounds present in these soils are in such form and amount as to be rendered harmless by the basic content of the drained soil without producing an acid condition due to base exhaustion. Furthermore, there is a sufficient covering of peat residues that, when mixed by cultivation with underlying sand, a humus sand soil results which compares favorably with other known humus soils in agricultural possibilities.

Profile structure of marsh soils, K. von See (*Internatl. Mitt. Bodenk., 10 (1920), No. 5–6, pp. 169–185*).—Studies of a series of profiles of north German marsh soils are described, showing how the general characteristics of moor soils may be exposed and studied by this method.

Soil survey of Early County, Ga., D. D. Long and E. C. Hall (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 43, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 313,600 acres in southwestern Georgia, which lies in that division of the Coastal Plain province known as the Dougherty Plain. The topography is undulating, with many lime sinks scattered over the surface. Drainage is generally well established, being for the most part subterranean. The soils are derived chiefly from unconsolidated marine sediments. Including swamp, 23 soil types of 14 series are mapped, of which the Norfolk sandy loam covers 30.9 per cent of the area.

Soil survey of Floyd County, Ga., D. D. Long (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 72, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 321,280 acres in northwestern Georgia, which lies in the Appalachian Valley physiographic province. All of the area except the flatwoods section is said to be well drained. The topography includes rolling table lands, high rolling ridges, high mountain plateaus, extensive river terraces, and low alluvial areas.

The soils are widely diverse in character and are of residual, sedimentary, colluvial, and alluvial origin. Including rough stony land, 37 soil types of 19 series are mapped, of which the Clarksville gravelly loam and Colbert silt loam cover 17.6 and 9.7 per cent of the area, respectively.

Soils of the Detroit area, M. M. McCool and G. M. Grantham (*Michigan Sta. Spec. Bul. 104 (1920), pp. 31, pl. 1, figs. 14*).—This survey deals with the

soils of an area of 987,520 acres in extreme southwestern Michigan, which includes Monroe County and parts of Wayne, Washtenaw, and Lenawee counties. The surface features are classed as sand drift, level to undulating lands, old deltas, gravelly ridges, and river flood plains. It is stated that the most important feature limiting maximum crop production in the greater part of the area is lack of drainage.

The soils of the area are mainly of glacial origin. The soil types mapped are clay loams, silt loam, fine sandy loam, brown sand, sandy loam, and sandy loam on gravelly subsoil. The brown sands are the most widely distributed of the soils and cover approximately 40 per cent of the area. The silt loam covers 30 per cent of the area and the sandy loam 15 per cent.

Soil survey of Pike County, Miss., A. T. Sweet et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, pls. 5, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 260,480 acres in southwestern Mississippi, the topography of which ranges from undulating to rolling, with some rough areas bordering the valleys of the larger streams. The area lies within the Coastal Plain province. Drainage is said to be in general well established. The upland soils of the area are of loessial and Coastal Plain origin. The first bottom and terrace soils are derived from the same materials reworked and redeposited. Seventeen soil types of 9 series are mapped, of which the Ruston fine sandy loam covers 57.1 per cent of the area.

Soil survey of Hoke County, N. C., E. S. Vanatta et al (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 266,880 acres in southern North Carolina, which lies near the western edge of the Coastal Plain province. The area lies in two distinct physiographic regions, known as the sand hills and the flat woods. The sand-hill region is a high rolling country, dissected by numerous drainage courses. The flat-woods section is gently undulating, with many level depressed areas, and drainage is in places deficient.

The soils of the sand-hill section consist chiefly of medium to coarse sand, more or less modified by weather, drainage, erosion, and other soil-forming agencies. They are said to be thoroughly drained. Including swamp, 10 soil types of 7 series are mapped, of which the Norfolk sand, the Hoffman sandy loam, and the Norfolk sandy loam cover 35.6, 24.1, and 20 per cent of the area, respectively.

Soil survey of Orange County, N. C., E. S. Vanatta et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 48, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 256,000 acres in central northern North Carolina, which lies in the Piedmont Plateau region. The topography is prevailingly rolling to hilly.

The area is thoroughly dissected by streams and there are no upland areas without drainage outlets. While there are flat areas through the uplands and the wider bottoms that are poorly drained, over the greater part of the county the surface water flows off so rapidly as to cause serious erosion.

All of the upland soils of the area are of residual origin. They are grouped into three classes, namely, light-colored sandy surface soils, heavy red soils, and gray to red silt or floury textured soils. Twenty-three soil types of 12 series are mapped, of which the Georgeville silt loam, Davidson clay loam, and Conowingo silt loam cover 29, 21.4, and 10.4 per cent of the area, respectively.

Soil survey of Vance County, N. C., S. O. PERKINS and W. A. DAVIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 31, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 170,880 acres in northern North Carolina, which lies wholly within the Piedmont Plateau province. The topography ranges from nearly level to rolling, hilly, and broken. The area is said to be well drained.

All of the upland soils are of residual origin. Including meadow, 21 soil types of 10 series are mapped, of which the Appling sandy loam, the Appling coarse sandy loam, and Wilkes fine sandy loam cover 20.1, 12.5, and 11.1 per cent of the area, respectively.

Soil survey of Wilkes County, N. C., R. C. JURNEY and S. O. PERKINS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 470,400 acres in northwestern North Carolina, which lies in the Piedmont and Appalachian provinces and ranges in topography from an elevated plateau, dissected and eroded by numerous stream valleys, to typical mountains. The county as a whole is adequately drained, and on the steep hillsides and cleared mountain slopes the drainage is excessive.

The soils are of a residual and alluvial origin. Including rough stony land, meadow, riverwash, and rock outcropping, 26 soil types of 10 series are mapped, of which the Cecil clay loam, Cecil loam, and Porter's loam, cover 21.6, 19, and 16.7 per cent of the area, respectively.

Soil survey of Spokane County, Wash., C. VAN DUYNE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 108, pls. 3, figs. 5, map 1*).—This survey, made in cooperation with the State of Washington, deals with the soils of an area of 1,123,840 acres in extreme eastern Washington, which occupies portions of the Okanogan Highlands and the great Plain of the Columbia River. High rolling to hilly areas and hilly to mountainous areas are fairly extensive in the eastern and northeastern parts of the county. Rolling prairie occurs in the southeastern part, balsatic plain mainly in the southwestern quarter, and glacial water-laid terrace areas mainly in the northern half. With the exception of a few basin-like areas the county is said to be well drained.

On the basis of origin the soils of the area are grouped as residual soils, glacial drift soils, water-laid material, wind-borne material, recent alluvial flood plain deposits, sedimentary deposits of the glacial lake basins, soils derived from accumulation of organic matter, and miscellaneous materials. Including scab land, rough mountainous land, rough stony land, rough broken land, marble sand, muck, and peat, 44 soil types of 20 series are mapped, of which Palouse silt loam, scab land, and Moscow loam cover 16.9, 12.6, and 8.6 per cent of the area, respectively.

The agricultural soils of the Union, C. F. JURITZ (*So. African Jour. Indus., 4 (1921), No. 1, pp. 76–84*).—A summary of existing knowledge of the geology of the soils of the Cape Province, Orange Free State, Natal, and the Transvaal is given. The soils of the Cape Province vary considerably, and are said to occur in more or less concentric bands with the gray and reddish loams forming the center and covering the largest area. The coastal belt in the southwest comprises gravelly clays of a drab color, while along the south coast the soils contain more humus and are frequently acid. The soils of Orange Free State and Natal are said to be more or less allied to those of the Cape Province, but the Transvaal soils are largely of very different geological origin. These soils appear to be sufficiently well provided with potash but deficient in phosphoric acid, nitrogen, lime, and humus.

The soils of Natal and the Transvaal.—I, The composition of Natal soils. II, The soils of the Transvaal, C. O. WILLIAMS and B. DE C. MARCHAND (*So. African Jour. Indus., 4 (1921), No. 2, pp. 177–187*).—Supplementing the above report, mechanical and chemical analyses of representative samples of Natal and Transvaal soils are presented and discussed.

In general, Natal soils are characterized by the almost complete absence of calcium carbonate, this giving rise to an acid reaction and a low content of available phosphates. Most of these soils are said to contain satisfactory amounts of potash.

The bulk of the soil of the Transvaal is sedentary alluvial soil, covering small areas. The chemical analyses show that less nitrogen appears to suffice than is considered adequate in European soils, and that nitrification is rapid in almost all types of Transvaal soil. These soils are in general deficient in lime, phosphoric acid, and organic matter in spite of their good nitrifying powers. Soils containing high percentages of iron oxid are common. The soils of the region are classified as heavy, medium to light loam, sandy, and alluvial soils.

Chemical investigation of some clay soils of Surinam, J. E. VAN AMSTEL (*Dept. Landb. Suriname Bul. 41 (1921), pp. [1]+33*).—Studies of the composition and properties of representative clay soils of Surinam in Dutch Guiana are reported and discussed, together with results of chemical analyses.

These clay soils were found to be rich in colloidal silicates and to be heavy and plastic. They have a high water capacity, a low permeability, and a capillarity somewhat greater than the average. They are poorly aerated and have a high specific heat and high adsorptive powers, resulting in a considerable content of plant nutrients. Drainage, liming, cultivation, and the incorporation of organic matter were found to be the more important steps for improvement of these soils. They were rich in both potash and phosphoric acid, but deficient in available potash and phosphoric acid. The total nitrogen content was somewhat higher than the average, but the soils were found to respond to nitrogen fertilization.

The chemical and biological aspect of bhata soil of Chandkhuri Experimental Farm, Central Provinces, A. R. PADMANABHA AIYER and D. V. BAL (*Agr. Jour. India, 15 (1920), No. 6, pp. 644–649, pls. 5*).—Physical, chemical, and biological studies of the lateritic bhata soils in the Central Provinces are reported. These soils were found to contain a very low proportion of fine material and to be deficient in phosphoric acid and lime.

Experiments with leguminous crops showed that bhata soils respond to manuring with phosphoric acid and organic matter. The ammonifying power was quite good and the nitrifying power average. Nitrogen fixation appeared to be weak. The poor growth of leguminous crops in the newly cultivated soil appeared to be due to lack of phosphoric acid and insufficient nodule formation. The latter difficulty was removed to a great extent by continuous cropping. These soils are porous and are well aerated and drained.

The partial sterilization of soils, E. J. RUSSELL (*Jour. Roy. Hort. Soc., 45 (1920), No. 2–3, pp. 237–246, pls. 4*).—A review is given of the work and methods of procedure at the Rothamsted Experimental Station on the partial sterilization of soils. It has been found that, while the use of heat in partial sterilization is perhaps more effective, chemical methods are much more convenient and potentially much cheaper.

The different studies have shown that in order to use chemical substances for the control of the soil population it is necessary to know exactly what organisms are to be dealt with, and to carry out direct experiments with those

organisms to ascertain the effects of the antiseptics on them. The general action of certain chemicals is discussed. It has been found that the question of disappearance of the chemical from the soil is of very great importance. Phenol, cresol, and the chlorcresols decompose quickly and become innocuous, but the nitro compounds do not. From the chemical point of view interesting possibilities are presented by these and certain other compounds which, having acted in the first instance as partial sterilizing agents, may decompose and give rise to valuable plant nutrients. Calcium sulphate, sodium cyanid, and pyridin are given as examples of such compounds.

Experiments with Dr. Kuhn's U-cultures, C. BARTHEL (*K. Landtbr. Akad. Handl. och Tidskr., 58 (1919), No. 2, pp. 85–95*).—Qualitative bacteriological analyses of samples of so-called universal cultures, developed by Kuhn, for promoting nitrogen fixation and nitrification in soils showed that the cultures contain both symbiotic and nonsymbiotic nitrogen-fixing and nitrifying organisms commonly occurring in soils.

When used in the treatment of seed of oats, cabbage, and potatoes for inoculation of the soil, no increase in crops resulted. Crop yields were apparently not influenced, and the cultures appeared to be inactive.

Soil renovation by the planting of legumes, E. E. BARKER (*Porto Rico Dept. Agr. and Labor Sta. Circ. 31 (1920), Spanish ed., pp. 3–16*).—Popular information on the use of legumes as green manure in the improvement of Porto Rico soils is given.

The procedure of yield in agriculture by increasing outlay.—The theory of the soil law, E. LANG (*Landw. Jahrb., 55 (1920), No. 3, pp. 337–403, figs. 7*).—This discussion takes in features of the laws of minimum, of physiological relations, and of decreasing returns, with particular reference to soils and their productiveness, and presents experimental data from different sources, leading to the conclusion that the law of decreasing soil yields can be expressed mathematically as a physiological law. On the other hand, the procedure of yield does not follow a simple scheme, but is always changing either through variable conditions of growth or by a temporary lapse in the growth of plants.

The effect of continuous cropping upon the major soil nutrients, G. R. STEWART (*Soil Sci., 11 (1921), No. 4, pp. 321–323*).—Studies conducted for six years at the California Experiment Station of the changes that occur in soil nutrients as the result of the growth of successive crops of cereals on six silty clay loam and seven fine sandy loam soils, previously described (E. S. R., 38, p. 813), are reported.

The soils were collected in 2-ton samples, each sample being divided between duplicate containers holding approximately 1,800 lbs. For the first season all containers were planted to barley, but in the succeeding years one container of each soil was cropped to barley while the other was left unplanted. During this time the soil was removed from the leaching effect of rainfall or excessive irrigation.

It was found that under continuous cropping these soils notably decreased in productivity. The average decrease in total crop amounted to 34.9 per cent.

There was no apparent reduction in the phosphate content of continuously cropped soils. However, a comparison of the results of five years showed that in five of the sandy loams there was a reduction of 30 per cent or more in the content of soluble phosphates, while only two of the silty clay loams had begun to show a decrease in this nutrient. There is said to be no indication so far that the lowering of the phosphate content accounts for the first decrease in the crop yield, for most of the soils whose soluble phosphates have been reduced are at the present time producing the best crops both of grain and of straw.

Determinations made before the soils were planted showed that the fine sandy loams contained from 0.05 to 0.09 per cent, and the silty clay loams from 0.13 to 0.18 per cent, of total nitrogen. There was a continual loss of this nutrient. At the close of the season of 1919 all of the soils, both planted and fallow, showed a reduction of from 14 to 38 per cent of their original total nitrogen content.

Soil reaction and choice of fertilizers, R. GANS (*Internatl. Mitt. Bodenk., 10 (1920), No. 5–6, pp. 186–196*).—The author discusses the chemical features of fertilizer selection on the basis of soil reaction. It is pointed out that the acidity of inorganic soil constituents is produced mainly by mixtures of hydrates of silica and alumina derived from soil weathering. The degree of acidity depends upon the intimacy of the mixture of these hydrates, the so-called molecular mixtures being the most strongly acid, followed in order by the so-called nonmolecular mixtures and the coarse mixtures.

New investigations on the agricultural value of forest litter, L. TSCHERMAK (*Centbl. Gesam. Forstw., 45 (1919), No. 9–10, pp. 193–219*).—Studies on the absorptive power and fertilizing value of forest litter are reported.

The absorptive power of the litter increased rapidly with its degree of decomposition, and when strongly decomposed was found to be due not only to its humus content but also to the coarser constituents, such as needles. The fertilizing value of forest litter was found to depend upon its content of both nitrogen and valuable mineral substance. The nitrogen content of decomposed forest litter is considerably greater than that of newly fallen needles and leaves, varying in the latter case from 0.5 to 0.8 per cent, while that of the humus in humid localities averaged from 2 to 5 per cent. The fertilizing value of forest litter compared favorably with that of winter rye straw when strongly decomposed, but was only about half so valuable when in fresh condition. Beech leaves were apparently more valuable than conifer needles.

Fertilizer experiments with new nitrogenous salts in 1920, HOFFMANN (*Mitt. Deut. Landw. Gesell., 36 (1921), No. 3, pp. 26–36*).—Data on 33 tests of 10 different nitrogenous fertilizers with 8 crops are reported and discussed.

The fertilizers included, among others, ammonium chlorid, ammonium sulphate nitrate, potassium and sodium ammonium nitrates, gypsum ammonium nitrate, and urea superphosphate. In most cases these fertilizers produced profitable increases. Special attention is drawn to the results produced by the urea superphosphate, which showed profitable increases in wheat and beet crops on soil which did not respond to fertilization with phosphoric acid.

Action of dicyandiamid on plant growth, T. PFEIFFER and W. SIMMERMACHER (*Landw. Vers. Sta., 90 (1917), No. 5–6, pp. 415–430, fig. 1*).—Experiments with oats on loam soil and a mixture of loam and sand, using lime nitrogen containing 13.89 per cent total nitrogen and 1.48 per cent dicyandiamid nitrogen, are reported.

It was found that the largest application of dicyandiamid did not hinder the germination of oats. However, there was a considerable injury to the grain yield later, which was not so marked on the loam soil. Only a small fraction of the dicyandiamid taken up by the oats plants was utilized for the formation of albumin, and there was a useless storage of albumin in the leaves and stalks of the plant. This is considered to explain the injury to the grain.

It is concluded that the use of lime nitrogen containing considerable dicyandiamid need cause no important injury to crop growth, but that the dicyandiamid must be considered a useless ballast to the plant.

Improvement of lime nitrogen, H G. Söderbaum (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 210 (1920), pp. 11; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 8, pp. 510–517*).—In order to avoid the bad effects of lime nitrogen as a fertilizer, it has been proposed in Sweden to convert it into urea before application to soil. In this connection cropping experiments with oats on sand soil, to determine the value of technical urea as a source of nitrogen, showed that urea was as effective in this respect as sodium nitrate and ammonium sulphate.

The retention of soluble phosphates in calcareous and noncalcareous soils, J. Sen (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 35–39*).—Experiments are reported which showed that the phosphoric acid of superphosphate is retained mainly through absorption in noncalcareous soils and through chemical combination in calcareous soils. No chemical reaction could be demonstrated between the calcium carbonate of calcareous soils and solutions of di- and trisodium phosphates. The retention of phosphoric acid in this case obeyed the absorption laws.

Studies of the distribution of phosphoric acid of different phosphates by percolation through columns of the two types of soil showed that the distribution of superphosphate was uniform through a noncalcareous soil, but not in calcareous soil, the major portion of the phosphoric acid being held in the top layers. This is taken to indicate that the phosphoric acid retained in noncalcareous soils is in a much more available form than in the calcareous soils.

The presence of even 5 per cent of calcium carbonate in a noncalcareous soil restricted the diffusion of the phosphoric acid of superphosphate. On the other hand, the distribution of the phosphoric acid of those soluble phosphates which are without action on calcium carbonate was uniform through a column of even highly calcareous soil. It is considered probable, therefore, that such phosphates would be more efficacious than superphosphate in calcareous soils.

Lime requirement and reaction of lime materials with soil, C. J. Schollenberger (*Soil Sci., 11 (1921), No. 4, pp. 261–276*).—Experiments conducted at the Ohio Experiment Station are reported, in which various lime materials were mixed with soil in undrained pots, watered, and kept partly outside and partly under greenhouse conditions, and determinations made of residual carbonate, lime requirement, and accumulated nitrates.

A relatively pure high-calcium limestone, calcite, and magnesite were very similar in behavior. Approximately one-half of an application equivalent to 3.1 tons per acre of these materials ground to pass a 100-mesh sieve was attacked within 4 weeks and two-thirds within 28 weeks. The natural carbonate dolomite was found to be about 50 per cent more resistant than the other materials, while precipitated calcium carbonate was much more easily attacked by the agencies of decomposition.

Caustic lime was apparently more reactive than the precipitated carbonate, although with time the differences noted became less. Carbonate formation was found to result from an application of chemically prepared magnesium oxid, and the amounts found gradually increased with time. On the other hand, the disappearance of carbonate from an equivalent application of chemically prepared magnesium carbonate was complete within a month, although traces of carbonate were afterwards formed. Of two samples of slag tested, so-called dicalcium silicate was found to react with soil as readily as precipitated calcium carbonate, but blast-furnace slag was less reactive than any other material tested.

Coarsely ground limestone had much less effect in reducing lime requirement than the finely ground. Limestone ground to pass a 100-mesh sieve was found to be utilized at nearly the same rate in an acid silt loam and an alkaline clay loam, but carbonate disappeared much more rapidly from an acid clay loam. The lime requirements by the vacuum method were comparable in the cases of the first two soils, but twice as great with the third.

The quantitative relations between bases not residual as carbonate and reductions in lime requirement were found to be reasonably close, a possible consumption of bases by nitrification being considered. The evidence obtained indicated that the interaction of soil constituents and calcium carbonate is sufficiently regular and quantitative for the indications of a lime-requirement method, based upon the reaction, to be of practical utility, provided the proper precautions are observed. The indications of the lime-requirement method employed were found to depend to a great extent upon such factors as the manner of preparation of the sample, the temperature, and the time allowed for the determination.

"No conclusive evidence has been obtained that heating is an undesirable feature of a perfect lime-requirement method, if we understand by that term a satisfactory method for the study of the relations between base absorbents and added bases in the soil. On the other hand, heat may be of great advantage in hastening a naturally slow reaction and may enable differences to be indicated with an exactness not otherwise attainable in a reasonable length of time."

Mechanism of the fertilizing action of sulphur, G. Nicolas (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 1, pp. 85–87; abs. in Jour. Soc. Chem. Indus., 40 (1921), No. 4, p. 124A*).—Experiments are reported which showed that sulphur exercises a favorable influence on the utilization of carbon dioxid by plants in addition to its other activities in the soil.

The nonbiological oxidation of elemental sulphur in quartz media, W. H. MacIntire, F. J. Gray, and W. M. Shaw (*Soil Sci., 11 (1921), No. 4, pp. 249–254; also in Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 310–313*).—A preliminary report is presented of studies conducted at the Tennessee Experiment Station on the oxidation of elemental sulphur in the presence and absence of appreciable quantities of iron, under aerobic and anaerobic conditions, with the unaltered medium, the sterilized medium, and the medium plus inoculation by soil infusion. The purest obtainable quartz was used as the medium.

It was found that elemental sulphur will oxidize upon moist contact with relatively pure quartz under both aerobic and anaerobic conditions. A distinct reducing and inhibitive effect was manifested by metallic iron under aerobic conditions, with a still greater similar tendency under anaerobic conditions. Limonite, on the contrary, exhibited a strong tendency to accelerate oxidation when used alone and when supplemented by magnesium and calcium carbonates. Also, the single additions of the several carbonates to the quartz-sulphur mixture increased the amounts of sulphates recovered under aerobic conditions.

The presence of sodium, calcium, and magnesium nitrates failed to alter the depressive tendencies of metallic iron, and the increase in salt concentrations exhibited an independent depressive action in the absence of metallic iron.

Fertilizer registrations for 1921, C. S. Cathcart (*New Jersey Stas. Bul. 350 (1921), pp. 5–35*).—This bulletin contains a list of registrations of fertilizer materials and mixed fertilizers offered for sale in New Jersey during the fiscal year ending October 31, 1921.

AGRICULTURAL BOTANY.

[Carnegie Institution of Washington, report of] department of botanical research, D. T. MacDougal et al. (*Carnegie Inst. Wash. Yearbook 18 (1919), pp. 57–102*).—Reports on different phases of work done during the year are noted below.

Character of protoplasm fundamental to growth, D. T. MacDougal.—The plant cell is characterized mainly by a predominance of pentosans. The metabolism of a predominantly proteinaceous unit includes the derivation of amino acids by breaking down albumins, while the amino compounds may be synthesized in the plant in which amination of the carbohydrates is the theoretical step in the construction of nitrogenous material. Growth in plants (including two processes which are outlined) is essentially a hydration expansion or swelling of a mass of pentosan-protein colloid or jelly. This forms a sac or inclosing layer of greater density, which takes in water and solutions by adsorption, imbibition and osmosis being controlled or affected by the hydrogen-ion concentration, salts, and amino compounds of the cell sap, and also by the composition of the medium or substratum and by other environmental conditions, as temperature.

The hydration of biocolloids simulating certain features of protoplasm, D. T. MacDougal.—Extensive experimentation with various biocolloids has shown that a mixture of carbohydrates and proteins may be made which will exhibit hydration relations similar to those of protoplasm. The reactions which are indicated are considered of primary significance in the mechanics of growth. Discussion is also given of data obtained during the swelling of dried sections as bearing upon the physical basis of cytological performances in the plant cell.

The effect of organic acids and their amino compounds on hydration and growth, D. T. MacDougal and H. A. Spoehr.—Tabular data and detailed deductions are presented as showing that equimolecular concentrations of the three organic acids considered present small divergence of effect on agar and more positive differences in agar-protein.

The solution and fixation accompanying swelling and drying of biocolloids and plant tissues, D. T. MacDougal and H. A. Spoehr.—The studies here noted relate to extractions from living cell masses, extractions or solutions of sections of biocolloids, acidity of fresh or living tissues, acidity of desiccated tissues, swelling of fresh sections, reswelling of extracted and dried tissues, swelling of dried tissues, and repetition of swelling and drying treatments. The treatments discussed, as applied to *Opuntia discata*, are described, with a statement of resulting data and conclusions.

Measurement of growth in terms of volume, D. T. MacDougal.—This is a study of the actual and relative increments in tomato fruits as ascertained by different methods of measurement during growth.

The daily course of growth in two types of fruits, D. T. MacDougal.—Tomato and walnut were taken as representative types of fruits, and the studies made thereon are reported in some detail.

Influence of soil aeration upon growth of shoots, W. A. Cannon.—In view of the possible survival value of some relations between roots and soil aeration, studies have been conducted (E. S. R., 41, pp. 132, 134) and are herein reported. The effects of oxygen deprivation on several plants are detailed.

The dendrograph [and work therewith], D. T. MacDougal.—A device for recording growth and other changes in volume of tree trunks during an entire season. Trees tested include *Fraxinus arizonica, Pinus chihuahuana, P. radiata, Quercus agrifolia,* and *Fagus grandifolia.*

The interrelation of photosynthesis and respiration, H. A. Spoehr and F. Long.—An extensive series of experiments, inaugurated to determine the rate of photosynthesis of isolated leaves in various stages of carbohydrate depletion, is summarized to the effect that leaves exhibiting high respiratory activity show correspondingly high photosynthetic activity, while leaves which are respiring at a low rate also fix carbon dioxid slowly. From experiments completed, a metabolic interpretation of the phenomenon of photosynthesis is considered most plausible, the whole process properly falling under that group of chemical changes designated as coupled reactions.

The most profitable conception of photochemical change is that which is based upon the principle of photo-electricity, and this favors the theory that loosening of electrons is prerequisite to photochemical reaction.

The manner in which the energy released by the respiratory actions is utilized by the plant remains unknown. The important point is the fact that the breaking down of food material, such as the relatively simple monosaccharids, yields energy in such a form and manner as to make possible synthetic activities.

Carbohydrate supply and respiration, H. A. Spoehr.—An extensive series of experiments planned to determine the rate of carbon-dioxid emission was carried out by the use of leaves cut from the plant and seedlings growing in various nutrient solutions, the results of which are discussed.

Nutritive value of food reserve in cotyledons, B. M. Duggar.—During the summer of 1919 a careful study was made of the effects of excising cotyledons after various time intervals up to 10 days after germination. Attempts were also made to substitute for the loss of the cotyledons by adding singly to the nutrient salt solution glycocoll, alanin, sodium asparaginate, urea, nucleic acid, and sodium nucleinate. None of these proved to be a nutrient substitute for the cotyledons.

Some factors in the salt requirements of plants, B. M. Duggar.—In work completed during July and August, 1919, special attention was directed to the determination of the most favorable proportions of the salts in a solution consisting of potassium nitrate, magnesium sulphate, calcium sulphate and soluble ferric phosphate, previous work having indicated special merit in such a combination of salts. A second group of experiments included a solution of iron, magnesium, and potassium salts in minimum quantities, with calcium supplied as monobasic calcium phosphate. Elaborate experiments are now in progress to determine the influence of various proportions of iron in the form of the soluble ferric phosphate contrasted with the insoluble ferric phosphate in solutions indicated.

Refinements in the indicator method of hydrogen-ion determination, B. M. Duggar.—The difficulties inherent in the hydrogen electrode method are said to be removable by the adaptation of certain types of colorimeters indicated. The development of such a method has been pursued, and the method is described.

Soil aeration experiments with helium, W. A. Cannon and E. E. Free.—Preliminary experiments with helium intermingled with air having proved harmless to ordinary plants, tests were made on sweet pea seedlings in tubes containing nitrogen alone and helium alone, or helium in slow motion. Root growth in the first two stopped at once, but was resumed when air was readmitted after three days, except in case of the main roots in the nitrogen tube. In the tube containing helium in slow motion, growth was little if any affected.

Stem analysis and elongation of shoots in the Monterey pine, F. Shreve.—During the summer of 1919 advantage was taken of several small cuttings that had been made for carrying out a stem analysis of the Monterey pine (*Pinus*

radiata). The elongation of the shoots was found to commence early in the spring and continue until September. No definite correlation was found between growth in height and growth in diameter during the last 4 to 7 years in saplings 12 to 15 ft. high. The individual conditions of crown development must be taken into account in exact analysis of such correlation.

Plant habits and habitats in the more arid portions of South Australia, W. A. Cannon.—Some of the more important conclusions and results derived from a field study of the vegetation in central, northern, and southwestern South Australia in 1918 are detailed. A list is given of particular adjustments of species to environment.

Reactions of roots of species with dissimilar habitats to different amounts of carbon dioxid in the soil, W. A. Cannon.—A study was made of *Covillea tridentata and Krameria canescens* from southern Arizona, and of *Mesembryanthemum* sp. obtained near the Coastal Laboratory, Carmel, Calif. The results of the studies are tabulated.

In these experiments the amount of oxygen available for the roots rapidly decreased with the increase in the amount of carbon dioxid in the artificial soil atmospheres used, so that to the specific effects of carbon dioxid must be added the effects following partial deprivation of oxygen. This, especially in the case of high percentages of carbon dioxid, is an important factor.

Size and form of leaves in desert plants, W. A. Cannon.—Tabulation and discussion are given of leaf width, length, and area in case of a number of South Australian plants.

The origination of xerophytism in plants, D. T. MacDougal and H. A. Spoehr.—The conclusions reached as the result of this and previous work are to the effect that succulence results from the conversion of polysaccharids into pentosan or mucilages, and xerophytism from a conversion of the polysaccharids into the anhydrids or wall material, both transformations being induced by a depleted or lessened water supply in the cells.

Seasonal changes in water relations of desert plants, E. B. Shreve.—For a number of years experiments have been conducted on a successful desert perennial (*Encelia farinosa*) and on two equally successful desert annuals, a winter annual (*Streptanthus arizonicus*) and a summer annual (*Amaranthus palmeri*), with a view to discovering any changes that may occur in their water relations with the march of the seasons. The hypothesis is presented that the increase or decrease of some substance or substances within the tissues affects the water-attracting power of the colloidal jellies, and thus brings about a greater resistance to water loss on the one hand and a greater absorption by the roots on the other hand. This theory was verified with *Opuntia versicolor*, and Encelia is to be tested for the same phenomena.

Observations on the vegetation of a desert valley and a soil-temperature survey of the United States and Canada, both by F. Shreve, the ecology of the strand vegetation of the Pacific coast, by W. S. Cooper, and transpiration and absorption by roots of fleshy Euphorbias, by E. B. Shreve, are also reported and discussed.

The inheritance of germinal peculiarities [in] flowering plants (*Carnegie Inst. Wash. Yearbook 18 (1919), pp. 137, 138*).—Flowers were produced in F_1 plants of a cross between the purple-leaved variety of the common barberry and the form extensively used for low hedges (*Berberis thunbergii*). It is thought possible that a tall barberry immune to wheat rust may eventually be produced from this cross. Other studies are briefly indicated.

Serological studies in the field of plant breeding, J. Becker (*Landw. Jahrb., 53 (1919), pp. 245–276*).—Studies are described as testing the avail-

ability of serological diagnosis for the purpose of ascertaining the origin and testing the purity of seeds.

Ecology [of plants], F. E. CLEMENTS ET AL. (*Carnegie Inst. Wash. Yearbook 18 (1919), pp. 330–343*).—New methods have been devised for using plants as measures or indicators. In grassland, at least, the line between natural and artificial indications is said to completely disappear as a result of a study of grazing by cattle and by buffalo. The use of standard plants to measure habitats in terms of plant response and growth has been extended to include a climax and a seral group of stations.

In the endeavor to measure the carbohydrate production of plants in the field and to correlate this with light intensity and water use, further studies have been made by F. E. Clements and F. Long in habitats with measured light conditions. These have dealt chiefly with the photosynthetic activity of different species in the same light value and of the same species under different light intensities. The latter appears to exhibit basic correlations with the definite adaptations shown in shade ecads. Studies of standard plants as to differences in photosynthetic efficiency at various elevations suggest that plants may respond to differences in total light intensity that can not be recognized by photometric methods.

The investigation by G. V. Loftfield of the behavior and efficiency of stomata in plants has been continued, attention being centered chiefly on the relation of stomatal opening and closing to the efficient factors, and especially to wilting and recovery. The results indicate that most if not all herbaceous species possess stomata having a decisive regulatory action at the time of wilting, even though they may show little activity under less severe conditions.

In the study of the ecology of root systems, by J. E. Weaver, the investigation of the root systems of dominants and subdominants of prairies, mixed prairies, and short-grass plains has been greatly extended, the trench or pit method having been continued in use. The character and extent of the root systems were found to be correlated with water content in nearly all cases. In general, soil type affects root development chiefly through its influence on water content, at least in the region studied. Soil texture, however, has a profound effect upon root penetration, and competition proved to be a primary factor in the control of root development.

The survey of the native rubber plants of North America, by H. M. Hall and F. Long, was brought to a close. Five latex-bearing species are thought to be of commercial value.

Progress reports on other projects at the laboratory are included.

Use of dilatometer in studying soil and plant relationships, M. M. MCCOOL and C. E. MILLAR (*Bot. Gaz., 70 (1920), No. 4, pp. 317–319*).—The authors repeated some experiments previously reported (E. S. R., 37, p. 116), obtaining additional information by means of the dilatometer used by Bouyoucos (E. S. R., 39, p. 18), the plants employed in the present study being rye, wheat, corn, and sweet and red clovers. These were grown on fertilized and untreated soils. The results as tabulated show data obtained at six dates indicated regarding the different lowerings of the freezing point (due to differences in solute concentration) at —1.5, —4, and —6° C. Discussion is given regarding these and other data not yet published.

The effect of two soil temperatures on the yield and water relations of healthy and diseased bean plants, W. H. BURKHOLDER (*Ecology, 1 (1920), No. 2, pp. 113–123, fig. 1*).—Experimentation here recorded was carried out early in 1919 at the temperatures 18 and 26° C. (64.4 and 78.8° F.). Tabulations are given of the weekly transpirations and of the accumulated results of the experiments. These are discussed in connection with certain disturbing factors.

The plants at 26° showed more vigorous growth and a greater transpiration rate, as well as a greater yield. Water requirements for seed production vary with conditions. The data on water requirements in the present article give indications only as to the effects of various factors covered, are rather limited, and are not considered as final.

Physiological isolation by low temperature in Bryophyllum, C. M. CHILD and A. W. BELLAMY (*Bot. Gaz., 70 (1920), No. 4, pp. 249–267, figs. 6*).—To experimentation briefly reported (E. S. R., 42, p. 435) as carried out with *B. calycinum, Phaseolus multiflorus,* and *Saxifraga sarmentosa,* the authors add a more elaborate account of studies on Bryophyllum.

It appears that cooling a zone of the petiole to a temperature of 2.5 to 4° C. for a few days is a very effective means of inducing the outgrowth of the leaf (axillary) buds, the opposite and neighboring leaves usually showing also more or less development. Since the movement of fluids to the leaves is not appreciably lessened, it is thought that no blocking influence of inhibiting substances transported is here involved.

Subcortical formation and abnormal development of stomata in etiolated shoots of Opuntia blakeana, J. G. BROWN (*Bot. Gaz., 70 (1920), No. 4, pp. 295–307, pls. 4, figs. 1*).—This paper reports details of a comparative study of *O. blakeana* as regards the appearance, form, and structure of the normal and etiolated shoots, and of the latter as affected by reexposure to light.

Composition of gases in intercellular spaces of apples and potatoes, J. R. MAGNESS (*Bot. Gaz., 70 (1920), No. 4, pp. 308–316, fig. 1*).—This preliminary report describes an apparatus intended to be used to obtain from fruits, tubers, etc., samples of their contained gases free from contamination with air, with an account of the methods of sampling these gases.

Data obtained from work with apples show a marked variation in the composition of the contained gases under varying temperature conditions. The data from potatoes were complicated by the presence of a larger degree of absorption of the gases. Factors influencing the amount and the significance of the ratio are discussed.

Viscosity values of protoplasm as determined by microdissection, W. SEIFRIZ (*Bot. Gaz., 70 (1920), No. 5, pp. 360–386*).—This paper represents a systematic attempt to ascertain from a study of plant and animal material the exact degree of consistency of protoplasm from numerous types of cells and under different physiological conditions.

Swelling of agar in solutions of amino acids and related compounds, D. T. MACDOUGAL and H. A. SPOEHR (*Bot. Gaz., 70 (1920), No. 4, pp. 268–278, figs. 6*).—The results of a study of the swelling of agar in solutions of amino acids, in alkaline hydroxids, and in ammonium salts, herein tabulated with discussion, as possibly bearing upon growth and metabolism, are considered as having sufficient importance to warrant a continuation of this work.

Relation of potassium to growth in plants, T. O. SMITH and O. BUTLER (*Ann. Bot. [London], 35 (1921), No. 138, pp. 189–225; also New Hampshire Sta. Sci. Contrib. 18 (1921), pp. 189–225; abs. in Gard. Chron., 3. ser., 69 (1921), No. 1794, p. 229*).—The authors give the results of a study carried on to determine (1) the effect of the absence of potassium on the growth of plants and (2) to what extent recovery is possible when potassium is supplied after more or less prolonged growth in its absence. The experiments were carried on with wheat, corn, and buckwheat, most of them being conducted in water cultures, with a few sand cultures.

It was found that the reserve supply of potassium in seed was not sufficient to maintain normal growth except for a very short period of time. The amount

of potassium contained in the seed did not in itself determine the length of time a plant grown from it could live in the absence of potassium without injury resulting. Symptoms of potassium starvation were found to appear early in the life of a plant, and were characterized by dwarfing of the axis and progressive death of the foliage, the older leaves succumbing first.

Recovery from potassium starvation was found to occur more slowly the longer the potassium was withheld from the plant. When potassium-starved plants were supplied with potassium the element became distributed promptly in accordance with the physiological needs of the plant. The relative potassium requirement per gram of dry matter in tops and roots was found to be the same in the case of wheat and corn, but in the case of buckwheat the requirement of the roots was higher than that of the tops. The amount of potassium usually utilized per gram of dry matter formed in normal plants of wheat and corn was substantially the same, but in buckwheat grown in the absence of potassium the amount utilized was considerably higher.

Flora of Swedish phanerogams, C. A. M. LINDMAN (*Svensk Fanerogamflora. Stockholm: P. A. Norstedt & Sons, 1918, pp. VIII+639, figs. 330*).—The descriptions are aided by a free use of drawings, several of which usually appear in each of the numbered figures.

New or noteworthy Porto Rican fungi, F. L. STEVENS (*Bot. Gaz., 70 (1920), No. 5, pp. 399–402, figs. 4*).—A brief descriptive discussion is given of *Anthostomella rhizomorphae*, *Zythia phaseoli*, the conidial phase of *Hyponectria phaseoli*, the new species *Linospora trichostigmae*, *Trabutia portoricensis*, *Hyponectria phaseoli*, and the new genus and species *Trabutiella cordiae*.

Studies in the metabolism of Actinomycetes, II, S. A. WAKSMAN (*Jour. Bact., 4 (1919), No. 4, pp. 307–330, pl. 1*).—In a continuation of work previously noted (E. S. R., 42, p. 434), the utilization of different mono-, di-, and polysaccharids, alcohols, and salts of organic acids as sources of energy for different Actinomycetes was studied.

The order of utilization of the different carbon compounds was found to be starch, glucose, lactose, maltose, glycerin, sucrose, cellulose, and the organic acids. The best growth was usually accompanied by the greatest reduction of the nitrates to nitrites and commonly by the greater increase of the pH value. Few Actinomycetes produced invertase, but even those that did not form this enzym utilized sucrose to some extent. The production of diastase by Actinomycetes was prominent and characteristic of the group, with few exceptions. Some Actinomycetes dissolved cellulose readily.

Further studies on the growth cycle of Azotobacter, D. H. JONES (*Jour. Bact., 5 (1920), No. 4, pp. 325–341, pls. 4*).—Regarding a continuation of work previously noted (E. S. R., 32, p. 33), the author reports on studies carried out with four varieties of Azotobacter isolated from garden soil at Guelph, Ont., in 1910. These organisms are said to have a complex life cycle, which is discussed.

A symplastic stage has been observed in cultures varying in age from a few days to several weeks. In this stage aggregations of cells coalesce, the cell walls appear to break down, and the plasma of the various cells intermingles, with the resultant production of regenerative granules varying in size from very minute bodies to considerably larger forms. On emergence from the symplasm these granules grow into young Azotobacter cells and reproduce by fission. Some involution forms appear to multiply to a very limited extent by a process of budding.

Thermophilic bacteria, D. H. BERGEY (*Jour. Bact., 4 (1919), No. 4, pp. 301–306*).—Data are given in tabular form resulting from an interrupted study of thermophilic bacteria (chiefly spore-forming) obtained from different sources.

Isolating single spores, C. D. LARUE (*Bot. Gaz., 70 (1920), No. 4, pp. 319, 320, fig. 1*).—A new method of isolating single spores has been devised, which differs from other methods in common use in the substitution of a mechanical method of marking the location of the spores in the poured plates for the usual procedure of marking with ink dots under the microscope. A modification of this method has been found of great use in the selection of spores of Pestalozzia.

FIELD CROPS.

Summer fallowing experiments in the Judith Basin, W. P. BAIRD (*Montana Sta. Bul. 138 (1920), pp. 39, figs. 3*).—Results of rotation and cultural experiments conducted at the Judith Basin Substation in cooperation with the U. S Department of Agriculture from 1908 to 1918, inclusive, with winter and spring wheat, oats, barley, flax, and corn grown on fallow land, grown continuously on the same land by different tillage methods, and in rotations by different tillage methods and sequences, are reported. Yield data and production costs under the various cultural methods and rotations are tabulated and discussed.

Winter wheat gave higher average yields (1910–1918) after fallow than after winter wheat or a green manure crop, while in tests of shorter duration (1914–1918) wheat after fallow gave higher returns than when following corn but lower than after green manure. Although much more costly than other soil treatments, summer fallow gave a profit. In the short experiment, disked corn land returned a decided profit, while the crop on summer fallow barely paid expenses, and that following green manure was produced at a loss.

Summer fallowing did not increase spring wheat yields, which averaged higher when following corn or oats. Excepting green manuring, the results indicate that for spring wheat, summer fallowing was the least profitable method tested. Oats averaged higher in yield on fallowed land than after oats, wheat, corn, or green manure, but the profit obtained from summer fallowing was less than from other tillage methods except green manure. Barley after fallow gave a higher yield than when following barley, corn, or oats, but the culture of the crop on fallow was less profitable than by any other tillage method, barley grown on disked corn land returning over six times the profit obtained on fallow. In the longer period (1909–1918) flax averaged higher after fallow than following flax, but in the shorter tests (1915–1918) produced less after fallow than after spring wheat, oats, or corn. The profits on summer fallow were less than with other tillage methods. Yields of corn fodder from fallowed land averaged less than from land continuously cropped to corn, but were slightly higher than after spring wheat or barley. Corn fodder produced on summer fallowed land was decidedly less profitable than by other tillage methods.

Annual percentage yields of winter wheat, spring wheat, and oats (based on the average of all plats of the crops considered) following summer fallow showed a tendency to increase progressively, while with continuous cropping to the same crop the percentage yields tended to decrease from year to year. In the case of barley this difference was less marked in the earlier years than in the later years of the experiment.

Small grain crops in 3-year rotations of spring wheat, oats, and a year of fallow gave higher yields than in similar rotations where corn took the place of the fallow year, or when these crops were grown continuously on fall plowed land, but the acre profits were lower. Profits obtained from a 3-year rotation of wheat, oats, and fallow were decidedly lower than from continuous cropping in the first period, 1909 to 1913, inclusive, while the soil was new, but

almost equal to those from continuous cropping in the second period, 1914 to 1918, inclusive, after the soil had been cropped for 5 years. This also held true with a 4-year rotation of fallow, wheat, oats, and corn.

Fallowing generally proved more profitable than a green manure crop in a 4-year rotation in the succession of fallow, wheat, corn, and oats, but about equaled green manuring in other 4-year rotations in which oats followed the fallow or green manure crop and wheat followed the corn. Small grains in 4-year rotations, including fallow, wheat, corn, and oats, averaged higher than oats and spring wheat grown continuously on fall plowed land, but such rotations were less profitable than continuous cropping to either spring wheat or oats.

[Report of field crops work in Rhodesia, 1919–20], H. G. MUNDY, J. A. T. WALTERS, and C. MAINWARING (*Rhodesia Agr. Jour. 18 (1921), No. 1, pp. 33–42, pls. 2*).—Cultural, variety, and rotation trials with corn; variety tests with peanuts, beans, and flax; field trials with miscellaneous cereal, forage, and root crops; liming tests; and studies of the effects of crops on each other, conducted at the Salisbury Experiment Station, are reported for the year 1919–20.

[Report of field crops work in Uganda, 1918–19], L. HEWITT, T. D. MAITLAND, ET AL. (*Uganda Dept. Agr. Ann. Rpt., 1919, pp. 16–20, 26, 44–48*).—Results of field tests with cotton, flax, sugar cane, rice, wheat, and sweet potatoes at various experimental centers are reported for the year ended March 31, 1919, in continuation of work noted heretofore (E. S. R., 42, p. 32). Reports of the Imperial Institute on tests of samples of fibers, tobacco, oil seed, and cotton from Uganda are also included.

Genetic studies on the protein content of maize, E. M. EAST and D. F. JONES (*Genetics, 5 (1920), No. 6, pp. 543–610, figs. 8*).—The authors analyze and discuss at length the work of the Illinois Experiment Station in breeding corn for high and low protein and oil content (E. S. R., 10, p. 844; 19, p. 940; 20, p. 531) and that continued by the authors as a cooperative project between the Connecticut State Experiment Station and Harvard University (E. S. R., 34, p. 431; 40, p. 323). Earlier work, where the chief object was to enhance the value of the crop by increasing the production of some chemical constituent, is also reviewed. Outstanding facts drawn from the data considered may be stated as follows:

The chemical composition is influenced by heterosis. The factors borne by a male gamete are practically without immediate influence on the seed they help to form. The protein content of the seeds of an F_1 hybrid, when corrected for the influence of the heterosis, is intermediate between that of the two parents with a tendency to be somewhat closer to that of the high potein parent.

While the authors do not maintain the desirability of breeding for high protein or other chemical constituents as a practical method of increasing food value or industrial utility, they suggest that it can be done in the following manner: Self-pollinate large numbers of plants artificially. Test the seeds produced by each individual as accurately as possible by the progeny-plat method. With the continuation of inbreeding if a large enough series be tested, near-homozygous plants with the ability to produce high protein seeds will be obtained. Some of the crosses between such types will have a high yield and will retain the power to produce large quantities of protein. While the percentage of protein in the vigorous hybrids will not equal that in the purified parent strains, it will be high and the protein per acre will be striking.

Regarding breeding for high protein, it is considered that "such results as are possible can be obtained most easily . . . by combining strains obtained by self-fertilization and selecting again from the recombinations ob

tained. Protein content is due to a large number of inherited factors, and various strains having the same percentage composition probably differ in respect to the factors inherited, so that there is a real chance for progress in their union. Since at the same time such a method increases productiveness by means of heterosis, it thus serves two purposes."

Experiments on the selection of yellow flint maize, 1916–1920, G. G. AUCHINLECK (*Mauritius Dept. Agr., Gen. Ser., Bul. 18 (1920), [English ed.], pp. 20, pls. 6*).—Information concerning corn breeding by selection is presented, botanical factors in the structure of the corn ear which influences selection are described, and details of field trials of selected strains are discussed.

The author found from extensive observations on the arrangement of flowers on the female inflorescence that the number of receptacles composing a whorl on the cob is not always the same, but that each type of ear has a whorl of a particular constant pattern. In a cross section of a carefully dissected ear, lines drawn joining the spaces between the two receptacles of the several pairs form a regular and simple rectilinear figure which may serve as the diagram of that type of ear.

A whorl can be regarded as a rectilinear figure upon each angle of which is set a pair of receptacles, and various types of ears may be classified according to the character of the figure, the diagram of ears of 12, 16, 20, and 24 rows of grain being respectively an equilateral triangle, a square, a pentagon, and a hexagon. Ears of the 10, 14, 18, and 22 row types are symmetrical in one plane only, and the diagrams for alternate whorls of the same ear are different. A 14-row ear is composed of triangular whorls alternately placed against four-sided figures, an 18-row ear of four-sided figures alternating with five-sided figures, etc. In another series of ears of 12, 16, 20, and 24 rows, all whorls of the same ear are of the same shape, but are so placed that on each whorl there are four adjacent receptacles. Such ears are symmetrical about two longitudinal planes, the plane passing through the central axis and between the central two of the four adjacent receptacles of each whorl, and the longitudinal plane at right angles to the first.

Certain points are common to all three types of ears. In no case are adjacent whorls of the same ear so arranged that the angles of their figures cover one another. The rows of grain on the ear are always double that of the sum of the angles of two adjacent whorls. No whorl ever differs from its adjacent whorl by more than one side, and four adjacent receptacles are not found more than once in the same whorl. These rules apparently hold for local types of yellow flint maize.

Variety tests with corn, 1917–1920, C. P. BLACKWELL, G. H. COLLINGS, and W. B. ROGERS (*South Carolina Sta. Bul. 207 (1921), pp. 19*).—Results of trials of corn varieties during the period 1917 to 1920, inclusive, are tabulated. Earlier work along this line has been noted (E. S. R., 36, p. 832).

Of the varieties tested throughout the period at the stations, Douthit led with an average acre yield of 37.4 bu., and was followed by Coker strains of Garrick, Marlboro, and Williamson, Belmont, and Lowman Yellow. Douthit with 59.6 bu. and Pee Dee No. 5 with 58.5 bu. led during the period at Pee Dee Substation, while Wannamaker Two-Eared was first in 1916 and Douthit first in 1919 at the Coast Substation.

Heritable variations in an apparently uniform variety of cotton, T. H. KEARNEY (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 227–242, pls. 7, fig. 1*).—This contribution from the Office of Alkali and Drought Resistant Plant Investigations, U. S. Department of Agriculture, presents evidence of the occurrence of heritable variations in the Pima variety of American-Egyptian

cotton. This variety, which originated with a single plant selection in 1910 and of which approximately 100,000 bales were produced in 1920, is probably the least variable of commercially grown cottons. Earlier work with this cotton has been noted (E. S. R., 40, p. 527).

The comparison of a progeny grown from seed of the parent individual of the variety with the present commercial stock exhibits significant improvement in the length and abundance of fiber, as well as in the uniformity of these characters. Indications of the occurrence of heritable variations were obtained in roguing fields of the Pima variety, the most distinct off-types besides a few very aberrant individuals with characters indicating hybridization with some other cotton variety, being either tall, vigorous individuals with exceptionally long internodes or stiff, slender, grayish plants having semierect branches and leaves, the leaves being narrower, more deeply lobed, and with more incurved and undulate margins than in typical Pima. The variations were much less numerous and of smaller magnitude than those observed in fields of the older Yuma variety. Breeding records also evidenced the occurrence of slight, heritable variations which could not be considered as outside the normal range of variation of this variety.

A much more striking variation, characterized by the complete or nearly complete absence of the dark red spot near the base of the petal, associated with an increased percentage of 4-lock bolls, was found to be heritable in a high degree. "The nature of this variation and the circumstances of its occurrence suggest the possibility that Upland cotton (*Gossypium hirsutum*) or Hindi cotton (*G. punctatum* Sch. and Thon.?) may have been involved in the remote ancestry of the Pima variety."

The finding of heritable variations in this apparently uniform variety is thought to justify the continuance of selection and line breeding and the roguing of seed increase fields.

Cotton facts, rev. by C. W. SHEPPERSON-BULL (*New York: Shepperson Pub. Co., 1920, 45. ed., rev. and enl., pp. 162+LXXXII, pls. 3, fig. 1*).—A revised and enlarged edition of the work noted previously (E. S. R., 34, p. 691).

Report to the Board of Trade of the Empire Cotton Growing Committee [with summarized addition], H. BIRCHENOUGH ET AL. ([*Gt. Brit.*] *Bd. Trade, Cotton-Growing Com. Rpt., 1920, pp. 74+8, pls. 7*).—This is the report of the British committee appointed "to investigate the best means of developing the growing of cotton within the Empire." The problems covered by the report include research, dissemination of knowledge, control of culture, and cotton marketing. Surveys of the cotton-growing areas, including studies of varieties, cultural and economic practices, and problems in the West Indies, Egypt, Sudan, Mesopotamia, Uganda, East Africa, Nyasaland, Rhodesia, the Union of South Africa, Nigeria, India, Queensland, and Oceania are presented in detail and summary form. Considerable statistical data are appended, together with maps of the world, West Indies, Egypt, Mesopotamia, South Africa, Nigeria, and India, indicating the cotton districts in the regions named.

Germination of seed of Phormium tenax (*Scot. Jour. Agr., 4 (1921), No. 1, pp. 79, 80*).—Germination tests of seed of New Zealand flax (*P. tenax*) grown in Scotland showed that the seed is slow to germinate and possibly does not retain the power of germination longer than one year. The standard method considered most applicable to a test of this seed is that used in testing the germinating capacity of the Chenopodiaceæ. The seeds are pressed lightly into damp sand and incubated at a temperature of 20° C. (68° F.) for 18 hours, alternating with a temperature of 30° for 6 hours.

[Experimental error in variety trials of rice], A. MCKERRAL (*India Bd. Sci. Advice, Ann. Rpt., 1918-19, p. 30*).—Results of investigations favored in

varietal tests the use of long narrow plats, 165 ft. by 6 ft., within one large evenly worked and flooded embanked field. The strips were carried across the field and separated from each other by a single line of a very late-ripening variety with a conspicuous erect type of leaf with reddish coloration. The probable error of the single plats was found to be 5 per cent, and by using 5 plats of each variety tested, differences of 10 per cent in yielding power could be detected.

[Rice production in the French colonies] (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 198–259, figs. 2*).—This series includes Production and Improvement of Rice in Indo-China, by G. Capus (pp. 198–214); Selection of Seed Rice by the Table of Certani, by C. Crevost (pp. 215–236); Rice in Madagascar, by Rollot (pp. 239–255); and Industrial Uses of Rice, by A. R. Fontaine (pp. 256–259).

Culture of sugar cane [in the French colonies] (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 107–191*).—A series of articles dealing with the production of sugar cane and cane sugar in the French colonies, including Culture of Sugar Cane in Martinique, by E. Bassières (pp. 107–133); The Sugar Cane Industry in Martinique, by Winter (pp. 134–140); Sugar Cane in Guadeloupe, by E. Isaac (pp. 141–147); Sugar Cane Culture in Madagascar, by A. Fauchère (148–166); Sugar Cane in Reunion, by Bertault et al. (pp. 167–173); New Cane Varieties, by Boname (pp. 174–182); The Sugar Question, by Fleuriot (pp. 183–185); and Sugar Legislation, by Chocarne (pp. 186–191).

Notes on improved methods of cane cultivation, G. Clarke, N. Husain, and S. C. Banerjee (*United Provs. Agra and Oudh, Dept. Land Rec. and Agr. [Pamphlet], 1919, pp. 23, pls. 10, figs. 2; also in Bul. Écon. Indochine, n. ser., 23 (1920), No. 144, pp. 633–652, pls. 10, figs. 2*).—Cultural experiments conducted at the Sugar Cane Research Station at Shahjahanpur are described and the trench method of cultivation outlined, together with a discussion of intensive cane culture.

Windrowing sugar cane in the Northwest Frontier Province (*India Dept. Agr. Mem., Chem. Ser., 5 (1920), No. 10, pp. 237–248, pls. 2*).—This memoir consists of two parts:

I. *The effect on the economic and agricultural situation*, by W. R. Brown (pp. 237–240).—Investigations in the Peshawar Valley showed the practice of windrowing sugar cane from 10 days to a month to be of advantage to sugar factories.

II. *The effect on the composition of sugar cane*, by W. H. Harrison and P. B. Sanyal (pp. 241–248).—Analyses of the juice of standing cane were compared with those of the juice of windrowed canes from the same field and showed that although windrowing tends to cause a deterioration in the purity of the juice, it brings about a concentration with the result that the amount of crystallizable sugar per unit weight of juice remains nearly constant. The weight of sucrose and crystallizable sugar in windrowed cane increases rapidly at first, is followed by a period during which the values remain practically constant, and then deterioration sets in. The period during which canes can be stored without deterioration appears to be determined by the incidence of heavy rain.

The concentration of sodium nitrate tolerated by tobacco plants, G. D. Buckner, A. M. Peter, and E. J. Kinney (*Soil Sci., 10 (1920), No. 6, pp. 487–491*).—Field experiments were conducted at the Kentucky Experiment Station, in which water containing amounts of sodium nitrate at the rate of 25, 50, 75, 100, 150, and 200 lbs. per acre in equal amounts of water, was applied to tobacco plants as they were set in the field to test the value of nitrate solutions in water used in transplanting.

On the day after setting, the plants receiving nitrate were more or less wilted, the degree of wilting varying directly with the amount, while those which received none were fresh and thrifty. The plants getting the smaller amounts of nitrate recovered, but those which received the largest quantity finally died.

The results of laboratory experiments involving the same solutions under conditions similar to the field led to the following conclusions: Sodium nitrate solutions in concentrations greater than 1 part to 3,750 parts of tap water cause a wilting which varies in intensity with the concentrations. Wilting more or less permanent in character is caused by concentrations of 150 parts of sodium nitrate to 3,750 parts of water and higher. Solutions containing 2 or 3 parts of sodium nitrate in 3,750 parts of water appear to give the best general development, even though there is a drooping at the outset.

When using a solution of sodium nitrate in setting tobacco plants or for plant beds, its concentration rather than the amount of nitrate per acre should be considered. The latter might be controlled, however, by regulating the amount of solution applied. The logical method for plant beds would be to make several applications at intervals.

Tobacco culture: Bright leaf or flue-cured tobacco, E. C. WESTBROOK (*Ga. Col. Agr. Bul. 199 (1920), pp. 36, figs. 13*).—A practical treatise on the production of bright leaf or flue-cured tobacco in Georgia, discussing cultural and field practices, insect enemies, diseases, curing, storage, and marketing. Brief information is given on the construction of curing barns, together with bills of materials and drawings of special construction details.

The production of bright tobacco, J. C. HART (*Va. Agr. Col. Ext. Bul. 62 (1920), pp. 31, figs. 7*).—Cultural, harvesting, curing, and storage directions considered essential to the production of bright tobacco in Virginia are outlined.

The production of tobacco in the French colonies, FALLETTI (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 3, pp. 291–310*).—The varieties, soils, and cultural methods involved in the production of tobacco in the French colonies are described briefly.

The weight of a hectoliter of wheat, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 34 (1920), No. 51, pp. 492–496, figs. 4*).—The several devices used in France to determine the weight of unit volumes of grain and other bulk materials are described and illustrated and their relative efficiencies compared.

Determination of the specific weight of cereals, P. VIEILLARD (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 3 (1921), No. 3, pp. 69–74, pl. 1*).—The author presents a detailed discussion of the above, and analyzes the work of Boerner (E. S. R., 36, p. 441) in standardizing methods of determining the test weight of grain.

The new Missouri seed law, J. MAYES (*Missouri State Bd. Agr. Mo. Bul., 17 (1919), No. 11, pp. 35, figs. 4*).—The text of the Missouri seed law effective January 1, 1920, regulating the sale, offering or exposing for sale of agricultural seeds, and providing for inspection and analysis is presented and discussed, together with illustrations of suitable forms for labeling the three distinct classes of seed provided in the act.

HORTICULTURE.

Pages from a garden notebook, MRS. F. KING (*New York: Charles Scribner's Sons, 1921, pp. XI+291, pls. 16, figs. 2*).—A popular discussion of gardens, plants, and related subjects.

Carbonic acid gas as a fertilizer, JESS (*Jour. Agr. Prat., n. ser., 35 (1921), No. 13, pp. 250–252*).—In greenhouse and field investigations on the effect of

applications of carbon dioxid to certain vegetable crops, the yield of greenhouse-grown tomatoes was increased from 29.5 kg. for an untreated house to 81.3 kg. for the treated. The yield of greenhouse cucumbers was increased from 138 to 235 kg.

Outdoor experiments with Irish potatoes resulted in increasing the weight of the average tuber from 140 to 330 gm. In an effort to determine the amount of carbon dioxid assimilated by the plants, two equal sized greenhouses, in one of which were growing 300 well-developed tomato plants and the other empty, were supplied with 1 per cent of the gas. A determination after a certain interval showed that the carbon dioxid content of the house with plants was markedly less than that of the empty house. The author believes that the gas escaping from organic manures has a marked influence on the growth of plants, and cites the results of an experiment with celery, carrots, and beans as evidence.

Report of dusting and spraying investigations, E. N. Cory (*Md. Agr. Soc. Rpt., 5 (1920), pp. 318–327*).—A report of 1920 investigations with various dusts and sprays in Maryland orchards and gardens.

In a test of dusts for the control of the terrapin scale on peach trees, at Smithsburg, three applications of a mixture of 60 per cent sulphur and 40 per cent lime resulted in a mortality of 94.2 per cent, as compared with 22.9 per cent for the untreated trees. The value of dust applications consisting of 85 per cent sulphur and 15 per cent arsenate of lead for the control of the strawberry weevil was shown by increased yield of fruit. A mixture consisting of 85 per cent sulphur and 15 per cent calcium arsenate gave complete control of the strawberry beetle. Dusting experiments on peas, beans, and tomatoes for the control of aphids, although yielding variable results, led the author to conclude that truck-crop dusting offers great promise.

Better seeds for truck growers, D. N. Shoemaker (*Md. Agr. Soc. Rpt., 5 (1920), pp. 362–366*).—A brief account of the author's investigations of variability in the Alaska pea. The study was prompted by the discovery of two undesirable strains of peas in Maryland in 1920, one a late and irregular maturing strain and the other yielding a dark undesirable canned product.

Inheritance studies with cabbage and kohl-rabi, Herrmann (*Gartenwelt, 25 (1921), No. 15, pp. 146–148, fig. 1*).—The inheritance of head and root formation was studied in cabbage, kohl-rabi, and closely related plants. Of 10 crosses involving cabbage, cauliflower, and Brussels sprouts, only one resulted in satisfactory head formation in the F_1 generation. On the contrary, in crosses between cabbage and kohl-rabi the enlargement of the root proved to be a dominant character. Crosses between the above species and more widely separated Cruciferae, such as mustard, charlock, radish, and rape, resulted in the formation of pods but no viable seed. The author points out the ease with which the closely related species are crossed by insects and other mediums, and points out the necessity of more intelligent care in seed production.

Argentine fruit industry, C. D. Girola (*Bol. Min. Agr. [Argentina], 26 (1921), No. 1, pp. 29–59, figs. 6*).—A brief review of the fruit industry of Argentina, including statistical data relative to imports of fresh and dried fruit. Cultural and varietal notes are given on the fruits grown in Argentina.

Notes on Indo and South China species of Pyrus, Juglans, and Castanea, A. Chevalier (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1335, 1336*).—Brief observations are given on certain wild and cultivated species of Pyrus, Juglans, Castanea, and Castanopsis. *P. pashia* and *P. granulosa*, found wild in the mountains of Indo-China, are suggested as possible root stocks. *J. duclouxiana*, cultivated in Yunnan, yields a thin shelled nut.

Pollination of tree fruits, F. DUJARDIN (*Rev. Hort. [Paris], 93 (1921), No. 17, pp. 300–302*).—A brief discussion of sterility and intersterility in the apple and plum. Coe Golden Drop, Coe Violet, Crimson Drop, and Jefferson plums were found to be unsatisfactory pollenizers for any other variety, whereas the Damsons and other varieties belonging to *Prunus insititia* proved of value for this purpose. The author obtained contradictory results in crossing Cox Orange with Sturner Pippin, and advises the necessity of thorough study before arriving at final conclusions.

Frost resistance in fruit varieties, O. BISSMANN (*Deut. Obstbau Ztg., 67 (1921), No. 21, pp. 98, 99*).—Several varieties of apples, pears, plums, and cherries are classified according to blooming period and degree of resistance to frost.

The Lorette method of pruning, E. BÜNSCH (*Deut. Obstbau Ztg., 67 (1921), No. 15, pp. 68–71, figs. 5*).—A discussion of the technic and merits of the Lorette method of summer pruning of apples and pears. The operation, consisting of the repeated cutting back of woody shoots with the resulting formation of flower buds at their base, is deemed of value by the author and is said to promote a greater and more regular production of fruit.

Ripening of pears and apples as modified by extreme temperatures, E. L. OVERHOLSER and R. H. TAYLOR (*Bot. Gaz., 69 (1920), No. 4, pp. 273–296*).—A detailed report on storage experiments with pears and apples, the substance of which has been already noted (E. S. R., 42, p. 832).

Orcharding (*Mass. Dept. Agr., Agr. Ser. No. 2 (1920), pp. 183, pls. 34, figs. 22*).—This is a revision of the fifth edition of the bulletin entitled Apple Growing, published in 1916.

Variation in seedling apples, F. C. BRADFORD (*Natl. Nurseryman, 29 (1921), No. 6, p. 152*).—A brief account of variations observed in the trunk girth of seedling apple trees of known parentage at the Missouri Experiment Station. Seedlings in which Geniton parentage was present were found to have an average circumference of 9.2 in., those without Geniton parentage, 12.7 in. All trees were growing on their own roots. Data for 7 of the 16 crosses represented in the orchard are presented in tabular form.

Northwestern apple packing houses, R. R. PAILTHORP and H. W. SAMSON (*U. S. Dept. Agr., Farmers' Bul. 1204 (1921), pp. 39, figs. 26*).—A contribution from the Bureau of Markets, U. S. Department of Agriculture, relating to the details of construction, arrangement, equipment, and operation of boxed apple packing houses, based on a study of commercial methods and practices. The text is abundantly illustrated.

The Herald—new type of prune, L. R. DETJEN (*Jour. Heredity, 11 (1920), No. 6, pp. 253–258, figs. 5*).—An illustrated paper, the subject material of which has been noted from another source (E. S. R., 45, p. 139).

Fertilizer studies with the grape, H. SICARD (*Prog. Agr. et Vitic. (Ed. l'Est-Centre), 42 (1921), Nos. 22, pp. 522–524; 23, pp. 550–553*).—In a comparison at Grammont, Mas Rouge, Mas de la Rode, and Rochet, France, of manure *v.* chemical fertilizers for grapes, the latter gave the larger yields at Grammont, Rochet, and Mas Rouge, while at Mas de la Rode an increased yield was obtained from the use of manure. Both manure and chemicals gave appreciable gains over the check plats.

The results of experiments conducted at Grammont and Mas Rouge to determine the essential fertilizing elements for the grape and the most desirable combinations thereof, presented in tabular form, indicated that dried blood was the most valuable source of nitrogen. At Grammont the combination of

nitrate and sulphate of potash proved superior to muriate of potash alone, at Mas Rouge there was no difference. At Mas Rouge acid phosphate proved the best source of phosphoric acid, while at Grammont there was no marked difference between the three forms used.

Training the grape, E. KUHLMANN (*Rev. Vitic., 54 (1921), No. 1398, pp. 271–274*).—The horizontal system of grape training is discussed, with special reference to the advantage over the usual French systems in increasing the yield, especially of the strong-growing hybrids.

Commercial grape growing, J. R COOPER (*Arkansas Sta. Bul. 174 (1921), pp. 3–39, figs. 23*).—Practical information is given on the culture of the grape in Arkansas, including propagation, laying out the vineyard, pruning and training, control of insect and fungus pests, and handling the crop.

A new hybrid—the Katharine blueberry, F. V. COVILLE (*Jour. Heredity, 11 (1920), No. 8, frontispiece, fig. 1*).—The fruits of this new hybrid blueberry average over 0.5 in. in diameter. A record of its origin is given.

The cultivation of the coconut in Porto Rico, P. GONZÁLEZ RÍOS (*Porto Rico Dept. Agr. and Labor Sta. Circ. 35 (1921), Spanish ed., pp. 20, figs. 5*).—Practical directions are given for the cultivation of the coconut palm with reference to site, selection of seed nuts, preparation of seed bed, planting, care of plantation, fertilizers, outline for a fertility test, disease and insect pests, and the preparation of fiber from the husk.

Coconut [fertilization] experiments (*Trop. Agr. [Ceylon], 56 (1921), No. 5, pp. 274–277, fig. 1*).—A summary of results with coconut fertilizers in experiments at Chilaw extending over the period 1915–1920. The trees receiving an annual application of 8 lbs. of steamed bone meal gave the highest average yield, but the gain over the nonfertilized, clean-weeded plat was very slight. The data are presented in tabular and graphical form.

Coachella Valley grapefruit, A. D. SHAMEL (*Citrus Indus., 2 (1921), No. 5, pp. 16, 17, fig. 1*).—A paper dealing with grapefruit culture in the Coachella Valley, Calif., and emphasizing the value of selected stocks.

The Satsuma orange in southern Alabama, A. D. SHAMEL (*Calif. Citrogr., 6 (1921), No 9, pp. 308, 328–331, figs. 6*).—A popular review of the development and present status of the Satsuma orange growing industry in southern Alabama, with particular reference to the utilization of scientific knowledge in propagation, control of disease and insect pests, and general orchard practices.

Economic plants of the Belgian Kongo, E. LEPLAE (*Bul. Agr. Congo Belge, 12 (1921), No. 1, pp. 87–90, 110, 111, 183–189, figs. 4*).—Brief notes are given on the behavior of citrus species, including the orange, grape fruit, and lemon, all of which are said to succeed admirably at Katanga. Notes are also included on the culture of the banana, papaya, and coffee.

The tree dahlia of Guatemala, W. POPENOE (*Jour. Heredity, 11 (1920), No. 6, pp. 264–268, figs. 3*).—A brief, illustrated account of a Guatemalan dahlia species, *Dahlia maxoni*.

Growing Easter lilies in the hardy garden, D. GRIFFITHS (*Gard. Mag. [New York], 33 (1921), No. 2, pp. 107, 108, fig. 1*).—A popular article pointing out the fact that the Easter lily may be grown in the garden as a hardy herbaceous perennial, and giving suggestions relative to propagation by bulblets and seed.

Native hawthorns for our gardens, J. DUNBAR (*Gard. Mag. [New York], 33 (1921), No. 2, pp. 102–107, figs. 5*).—This paper on the North American hawthorns points out their remarkable decorative value and discusses the 21 natural groups in relation to distribution and valuable species, giving in some instances the distinguishing characteristics of the groups and species.

The American rose annual, 1920 and 1921, edited by J. H. McFarland (*Amer. Rose Ann., 1920, pp. 188, pls. 20, figs. 7; 1921, pp. 192, pls. 17, figs. 13*).—The 1920 annual, similar to those of preceding years (E. S. R., 41, p. 242), contains papers on breeding, variety testing, and other phases of rose production in this country and abroad. The list of roses introduced in America is revised to March 17, 1920.

A paper on Rose-breeding Notes for 1919, by W. Van Fleet (pp. 23–30), records the author's rose-breeding activities for the year 1919 at Glendale, Md. Many new and little used species were successfully used as parents, notably 13 species from north and central China. Of these *Rosa gentiliana* and *R. helenae* are deemed of greatest promise. *R. moyesii*, on account of the handsome deep red color of its bloom, is considered very valuable and has been used extensively. *R. wichuraiana* is said to have given very satisfactory results when crossed with florist varieties. Many other species are discussed in relation to their own merit and that of their seedlings.

Night Growth of Roses, by A. W. Greeley (pp. 40–42), is a brief account of studies made on the growth of hybrid tea rose varieties, including Lady Pirrie, Radiance, and Killarney Queen. Measurements of cane growth showed a night growth of approximately 63 per cent for Lady Pirrie, 80 per cent for Radiance, and 54 per cent for Killarney Queen.

The National Rose Test Garden to Date, by F. L. Mulford (pp. 137–145), is a tabulated report of the behavior of rose varieties in the Arlington, Va., test garden.

The Story of the Baby Ramblers, by F. L. Mulford (pp. 57–59), and A Serious Menace to Greenhouse Roses, by C. A. Weigel (pp. 66–69), are also among the papers included.

The 1921 annual contains contributions from all over the world upon progress and activities in the culture and breeding of the rose in 1920. The official list of American roses is corrected to March 10, 1921.

Rose Breeding in 1920 at Bell Experiment Plat, by W. Van Fleet (pp. 25–31), records the author's activities in rose breeding at Glendale, Md., during 1920. "Particular attention was given in 1920 to the utilization of the lesser-known northern species of both hemispheres, such as *Rosa inodora*, *R. pulvurulenta*, *R. murielae*, *R. hibernica*, *R. micrantha*, *R. involuta*, and *R. jundzillii* of the Old World, our native *R. macounii* and *R. nutkana*, and the most northern forms of *R. nitida*, *R. pratincola*, and *R. lucida* or *R. virginiana*." The intrinsic and breeding values of *R. willmottiae*, *R. hugonis*, *R. xanthina*, *R. hispida*, *R. bella*, and *R. moyesii* are discussed.

Rose Stocks and Root Systems, by H. H. Hume (pp. 47–54), is a discussion of the merits of several different rose species as source of rootstocks. The author points out his succesful experience with the Double or Evergreen Cherokee.

Our Native Roses (pp. 34–43) and Select Roses for a Washington Garden (pp. 89–93), both by C. E. F. Gersdorff, are also among the papers included.

Tree planting in Texas towns and cities, L. Wyman (*Tex. State Forester Bul. 11 [1920], pp. [38], figs. 18*).—This descriptive circular relative to the shade trees of Texas towns and cities, gives notes on their value, regional adaptation, and peculiarities. Lists are included of the trees best adapted to the east, central, south, southwest, and panhandle sections of the State. Directions are given for the planting and care of young trees, with notes on insect and fungus pests.

Pruning, F. L. Mulford (*Amer. Forestry, 27 (1921), No. 330, pp. 390–393, figs. 5*).—A brief, popular article on the pruning of ornamental trees and plants.

FORESTRY.

Forestry in relation to land economics, W. D. STERRETT (*Jour. Forestry, 19 (1921), No. 3, pp. 224–236*).—A discussion of the importance and necessity of establishing a systematic program of land classification in the United States to determine especially land to be recommended as economically best suited for the growing of forests, public and private. The forest policies of England and this country are discussed, and a résumé of the findings of a committee on land classification, appointed at a conference of U. S. Department of Agriculture workers, is included. The author believes that forestry often has a general advantage over agriculture as a form of land utilization, and strongly urges that all public forestry agencies should enter the field of land classification and that the national forest program should concentrate largely on land classification with reference to what lands should be used for forests. A plan of work is suggested for local or county land classification.

Comments on the paper by L. C. Gray, of the Office of Farm Management and Farm Economics, are appended.

A forest policy for Florida, J. G. PETERS (*Fla. Grower, 24 (1921), No. 1, p. 6, fig. 1*).—An address delivered before the Forestry Congress, at Tallahasse, Fla., in April, 1921, in which the author points out the depletion of Florida forests and emphasizes the need of a systematic forestry policy, the principal feature of which should be fire prevention.

Forestry in the United Kingdom (*London: Govt., 1920, pp. 43*).—A statement prepared by the Forestry Commission for the British Empire Forestry Conference held in London in 1920. The subject is treated under the following headings: General description of the country; main types of forest growth and their distribution; area covered by existing forests; notes on the most important timbers; ownership of forests; relationship of the State to the forests; the forest authority; forestry activities of municipal and corporate bodies and private individuals; professional and other societies interested in forestry; education, research, and experimental work; annual increment and utilization of home-grown timber; forest industries; exports and imports of timber; and summary and outlook.

Statement prepared for the British Empire Forestry Conference, London, 1920, C. E. LANE-POOLE (*Perth, West. Australia: Min. Forests, 1920, pp. 35, pls. 20*).—A statement of the forest resources and activities of Western Australia prepared in a similar manner to the above, but amplified by the addition of maps, chiefly illustrating the distribution of the important species.

Annual reports of the Crown Land Department of the Province of New Brunswick for the years ended October 31, 1919, and October 31, 1920 (*New Brunswick Crown Land Dept. Ann. Rpt., 59 (1919), pp. 210, pls. 29; 60 (1920), pp. 101, pls. 3*).—The report for the year 1919 contains, in addition to the customary administrative and fiscal statements, subreports relating to mining, water power, forest fires, forest survey, the spruce budworm, experimental cuttings, game protection, and the annual growth of various trees. In the fourth annual statement of the progress of the Forest Survey of the Crown Lands, by G. H. Prince (pp. 116–124), it is stated that approximately 530,000 acres were examined during the year, bringing the total to 29 per cent.

The report for 1920 is much the same as the above. In the fifth annual progress statement of the Forest Survey of the Crown Lands, by Prince (pp. 78–81), it is stated that 926,442 acres were surveyed during the year, completing 42 per cent of the total Crown-land area.

The burning of dead and down trees as a practical protection measure, R. B. WEAVER (*Jour. Forestry, 19 (1921), No. 5, pp. 506–511*).—A brief account is given of an experiment carried out in late October and early November, 1920, in the Modoc National Forest, California, to determine the cost and efficiency of the burning method of destroying dead standing and fallen trees. The burning was done in a pure stand of western yellow pine, averaging about 15,000 ft. per acre.

"An area of 2,000 acres was covered in 11 days' work. During this period 4,600 standing and down trees were set on fire. Of this number 1,695 were standing and 2,905 were down trees. Not less than 80 per cent of the standing trees burned to such an extent that they fell a few hours after being fired. A very considerable per cent burned up entirely after falling. A greater part of the down trees were consumed, so that a much cleaner area existed, with no damage having been done to the living trees or reproduction." The work, performed at an average cost of 14 cts. per acre, was, according to the author, much less expensive than any other method and equally as satisfactory in results.

Yellow birch and its relation to the Adirondack Forest, E. F. MCCARTHY and H. C. BELYEA (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 12 (1920), pp. 50, pls. 2, figs. 6*).—The types and conditions of yellow birch (*Betula lutea*) found in the Adirondacks are discussed, and comparative data are presented to show the silvicultural relation of birch to other native species. Yellow birch is said to have an advantage over the beech, sugar maple, and red maple in the seizure of devastated areas, in that its seeds are more motile and more numerous, and its seedlings root easier and grow more rapidly. Among the topics taken up are the influence of logging and of burning on the forest, planting on cut-over lands, growth of hardwood saplings, and growth and yield of yellow birch in pole and virgin stand.

A research on the eucalypts, especially in regard to their essential oils, R. T. BAKER and H. G. SMITH (*N. S. Wales, Technol. Mus., Tech. Ed. Ser., No. 24 (1920), pp. XV+471, pls. 75, figs. 221*).—A second, enlarged, and verified edition, the original of which has been previously noted (E. S. R., 14, p. 1076). The geographical area covered embraces New South Wales, Victoria, Tasmania, South Australia, and Western Australia, a considerable extension beyond that of the first edition.

Palm trees of the lower and middle Kongo, R. P. H. VANDERYST (*Rev. Gén. Agron., n. ser., 11 (1921), No. 2, pp. 33–46*).—A descriptive article on the palms of the Kongo, in which the author, dividing the trees in five groups, describes the more important species and gives notes on their distribution and economic value.

Contribution upon the life history of Populus tremula, D. BURGER (*Beiträge zur Lebensgeschichte der Populus tremula L. Thesis, Eidg. Tech. Hochsch., Zurich, 1920, pp. 79, pl. 1, figs. 32*).—A technical study of the European aspen (*P. tremula*), in which the morphology and physiology of the buds, bud scales, petioles, and leaves are discussed in detail. Attention is drawn to the variation in shape of leaves from different parts of a tree and to the cause of trembling of the leaves.

Regional development of pulpwood resources of the Tongass National Forest, Alaska, C. G. SMITH (*U. S. Dept. Agr. Bul. 950 (1921), pp. 40, pls. 4, figs. 2*).—This contribution from the Forest Service presents information on the timber and other resources of the Tongass National Forest in Alaska. The statement is prepared "to indicate the capital and organization necessary for the development of Alaskan pulp and paper mills, to show what data on

the timber resources of that region have been and are being collected by the Forest Service, and to outline the conditions of purchase of timber on the National Forests."

Western hemlock (*Tsuga heterophylla*) is said to constitute 60 per cent and Sitka spruce (*Picea sitchensis*) about 20 per cent of the merchantable timber of this forest. Data are given on climate and geographic features of the region, the amount and quality of the timber, labor, water supply and power, procedure in Government timber sales, etc. A sample copy of the agreement to be drawn between the Forest Service and purchasers of timber is included.

Indian timbers, R. S. TROUP (*Indian Forester, 47 (1921), No. 5, pp. 196–209*).—A paper read before the Indian Section of the Royal Society of Arts, January, 1921, presenting descriptive notes and observations on some of the more important timbers of India, especially those of export value. Teak, sal, and deodar are deemed the three most valuable species. Attention is drawn to the part Indian timbers played in the war.

DISEASES OF PLANTS.

[Plant pests and diseases, Philippine Islands], A. HERNANDEZ (*Philippine Agr. Rev., 12 (1919), No. 2, pp. 85–93, pls. 5, fig. 1*).—Besides including an account of animal pests, this report deals with the investigation of diseases of the coconut palm, in particular the rôle of insects in the spread of bud rot (*Bacillus coli*); a disease, *Ustilago virens*, causing swelling and orange color in rice grains; a hitherto unknown rice disease, *Phyllosticta miuai*, reported at the Lamao Experiment Station, and what appears to be the Fiji disease (*Plasmodiophora* sp.) of sugar cane.

Some observations on Erysiphe polygoni, G. O. SEABLE (*Brit. Mycol. Soc. Trans., 6 (1919), pt. 3, pp. 274–293*).—In field trials carried out during 1913–14 at the Southeastern Agricultural College, Wye, and in part previously noted (E. S. R., 34, p. 52), the author found no variety immune to *E. polygoni* out of 27 varieties of swedes, turnips, and rape. "In inoculation experiments with cultivated varieties of *Brassica campestris* and *B. oleracea*, the form of *E. polygoni* infecting these varieties was found to be a biologic form, with this additional distinction that inoculations from *B. campestris* to *B. oleracea* invariably gave subinfections as the result. Biologic forms on *Polygonum aviculare*, *Trifolium pratense*, and *Pisum sativum* were indicated. Subinfections on varieties of *B. oleracea* were observed in the field and found to exist over the winter and in some cases grow into full infections. Inoculations were undertaken in the laboratory and were successful both on uninjured leaves and on the internal tissues of stems; these latter were carried as far as the fourth generation. Inoculations with conidia from subinfections were carried out and the conidia shown to be viable. It is suggested that the most probable method of overwintering of the biologic form of *E. polygoni* on the cultivated Brassicae is by means of subinfections on varieties of *B. oleracea*, aided by persistent mycelium on varieties of *B. campestris*."

Bacterial blight of beans, C. W. RAPP (*Oklahoma Sta. Bul. 131 (1920), pp. 39, figs. 17*).—The results are given of a technical study of the bacterial blight of beans due to *Bacterium phaseoli*, in which the author describes the field characteristics of the disease under Oklahoma conditions, presents evidence regarding the means by which the organism passes the winter and the modes of infection and dissemination, and gives practical means for the control of the disease.

Considerable variation was observed in the susceptibility of different varieties of beans.

In the experiments for the control of bacterial blight various methods were tested. Bacteria were found to survive the winter in, or on, the seed, in the soil, and on bean straw. Spraying proved of no value as a control measure, and seed treatment by chemicals, hot water, and dry heat was found impracticable on account of the effect the treatment had on the germination of the seed. Pod selection was found to have some advantage, and the planting of blight-resistant strains of beans is recommended. The most practical method of control appears to be the use of old seed, no disease appearing in any of the plants where two or three-year-old seed was planted. In germination tests of a considerable number of varieties of beans it was found that the percentage of germination did not diminish materially until seed was more than three years old.

Bacterial wilt of castor bean (Ricinus communis), E. F. SMITH and G. H. GODFREY (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 255–262, pls. 13, fig. 1*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors describe a bacterial wilt of castor beans found to be due to *Bacterium solanacearum.* The disease was first called to their attention in May, 1918, and a survey made at a later date showed the occurrence of the disease at or near a number of towns in Florida, as well as in Georgia and Alabama.

The disease is characterized by a rapid wilting, and if the plants are small they may be destroyed. If the infection takes place late in the season it may not result in the permanent wilting or death of the plants, but usually in such cases marked dwarfing of the plants occurs.

The organism causing the wilt was isolated from castor beans, and successful inoculations were made on tomato plants, jimson weeds, and the common nasturtium. Subsequently young cotton plants were infected, as were vanilla, grown in hothouses, and young sunflowers. In 1920, the dwarfing of castor bean plants was obtained with *B. solanacearum* isolated from wilted North Carolina tobacco. Fuchsias were also shown to be susceptible.

Stewart's disease of corn, F. V. RAND and L. C. CASH (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 263, 264*).—As a result of an investigation carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, the authors report a disease of corn which is due to *Aplanobacter stewarti* as occurring in Georgia, South Carolina, Tennessee, Virginia, Kentucky, Missouri, Iowa, Illinois, Indiana, Ohio, Pennsylvania, District of Columbia, Maryland, Delaware, New Jersey, southern New York, and Connecticut.

It is said that under field conditions the number of diseased plants is usually under 20 per cent, but among early varieties of sweet corn sometimes 100 per cent infection has been found. Tests were made of seed of 53 varieties of sweet corn purchased in the open market and planted in three seasons. As a result of these plantings it was found that the later varieties consistently gave a low percentage of the disease, while the earliest varieties under the same conditions showed a serious loss from wilt. In general, wilt prevalence among mid-season varieties was between these two extremes.

An investigation was carried on to determine whether infection could come from the soil or proximity to diseased stalks, but thus far no evidence has been secured to indicate these as sources from which the organism can be transferred. Infection of the young corn plant from the seed was found to be largely dependent upon the growth condition of the seedling during the first week or two after planting, as influenced by soil moisture, soil texture and

fertility, and temperature. It appears that anything which retards the germination and early development of the seedling lessens the chances of infection from the seed.

Control methods have been undertaken but they are still in the experimental stage. However, preliminary results are said to indicate that northern-grown seed is less liable to carry infection than that grown farther south, and that infected seed may be rendered safe for planting by a dry-heat pasteurization at 60 to 70° C. for one hour.

Arkansas cotton diseases, J. A. ELLIOTT (*Arkansas Sta. Bul. 173 (1921), pp. 3–26, figs. 26*).—Popular descriptions are given of a number of the more common diseases of cotton, the descriptions being designed to enable the reader to distinguish between the various diseases and tell their causes. So far as known, methods of control are suggested.

In connection with the discussion of the angular leaf spot due to *Bacterium malvacearum*, the author reports experiments in delinting the cotton seed with sulphuric acid before planting and in the use of old seed. Where the seed was delinted no angular leaf spot, anthracnose, or Diplodia boll rot appeared upon the plant, except where plants had been artificially infected or the disease had gained entrance from untreated fields. In the case of the testing of old seed no disease appeared on any of the plats except where one- or two-year-old untreated seed was used.

Yellow-leaf disease in Phormium tenax (*New Zeal. Jour. Agr., 19 (1919), No. 2, pp. 89–93*).—Extracts, with discussion, from reports made by L. Cockayne, detail the nature and progress of flax yellow-leaf disease, which has in recent years caused grave concern in regard to the flax-milling industry in New Zealand.

The author now considers yellow leaf an infectious disease, probably due to attack by fungi or bacteria. The view that yellow leaf is favored by stagnant water is upheld. The periodical examination of marked plants has shown, among other facts, that a great improvement occurs in autumn and winter, followed by progressive deterioration in spring and summer; that plants or portions thereof may remain healthy in close proximity to diseased plants; that a portion of a diseased plant which by extension of the rootstock reaches level ground generally becomes healthy and makes good flax; that diseased plants frequently recover completely; that great fluctuations may occur during the year; that very few plants die outright; and that some plants appear to be immune to the disease.

[Potato canker], E. SCHAFFNIT and G. VOSS (*Ztschr. Pflanzenkrank., 27 (1917), No. 7–8, pp. 339–346*).—Potato canker studies during 1916 dealt with soil disinfection, varietal resistance, and viability of the spores of the potato canker organism (*Chrysophlyctis endobiotica*). Disinfection and varietal resistance data are given in tabular form. Soil was found to retain infection in virulent form after eight years.

Origin of potato rust, J. C. ARTHUR (*Science, n. ser., 53 (1921), No. 1367, pp. 228, 229*).—In a previous publication (E. S. R., 43, p. 346), the author called attention to a potato rust in Central and South America. Since that time the fungus has been reported in one field in Florida, but as a precaution all vestige of it was destroyed. The author reports that during 1918 this potato rust (*Puccinia pittieriana*) was very abundant and harmful on the experiment station grounds at Ambato, Ecuador, not only on potatoes but more so on tomatoes, showing a decided preference for the North American varieties of tomatoes. Mention is made of two rusts, one from Colombia on *Sarache edulis*,

a close relative of Solanum, and the other on *Solanum triquetrum*. These differ in some particulars, so that it is not possible to state whether they are distinct species or not. The occurrence of these three forms in Central and South America is considered evidence that the potato rust has originated somewhere between Ecuador and Costa Rica on hosts native to those localities.

Progress in 1918 in controlling potato diseases, G. R. BISBY (*Minn. Hort., 47 (1919), No. 12, pp. 462–465, figs. 2*).—Treatment of potato plats during 1918 showed the best results from the use of corrosive sublimate as a seed disinfectant. The results as tabulated show the value of planting perfectly clean seed if obtainable, and otherwise of disinfection. Copper sulphate solution, 3 lbs. to 50 gal. of water, has proved valuable in trials extending over four years.

Rotation studies show that disease organisms increase in the soil when a crop is grown continuously. Results secured in 1918 show, further, the value of removing weak and run out plants from the stock which is to be saved for seed. These weak plants produce very poor progeny. More careful handling of potatoes after harvest is also necessary. Rot organisms gain entrance especially through wounds in the tubers, which are brought about particularly by careless handling during and after harvest. Storage bins should be cleaned and disinfected.

Potato diseases (*Meded. Phytopath. Dienst Wageningen, No. 6 (1919), pp. 19, pls. 6, figs. 4*).—Brief accounts are given of potato diseases (and appropriate protective measures), including leaf roll (phloem necrosis or leptonecrosis), Rhizoctonia disease (*Hypochnus solani*), leaf curl (*Verticillium albo-atrum*), mosaic, blackleg (*Bacillus atrosepticus*), late blight (*Phytophthora infestans*) and soil sickness.

Sugar cane matizado or yellow spot, R. DEL VALLE ZENO (*La Enfermedad del Matizado o Manchas Amarillas de la Cana de Azucar. New York: [Author], 1919, pp. 16, pls. 2*).—It is claimed that matizado or yellow stripe of sugar cane is associated with a deterioration of the root system, leading to a dimunition of the supply of nutritive materials to the plant. Reference is made to investigations regarding the nature, effects, and possible control of the disease.

Diseases of sweet potatoes, M. T. COOK and R. F. POOLE (*New Jersey Stas. Circ. 123 (1921), pp. 3–24, figs. 17*).—Popular descriptions are given of yellow stem or stem wilt, black rot, soil rot, scurf, and soft rot, all of which are the more important sweet potato field diseases occurring in New Jersey. A number of other diseases are briefly described, and suggestions are given for their control so far as definite means are known.

Glucose as a source of carbon for certain sweet potato storage-rot fungi, J. L. WEIMER and L. L. HARTER (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 189–210*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give an account of experiments designed to determine to what extent glucose occurring in sweet potatoes can be utilized as a source of carbon by *Fusarium acuminatum*, *Diplodia tubericola*, *Rhizopus tritici*, *Mucor racemosus*, *Sclerotium bataticola*, *Penicillium* sp., *Botrytis cinerea*, and *Sphaeronema fimbriatum*.

The different fungi were grown on a modification of Czapek's solution, to which different amounts of glucose were added as a source of carbon. All the fungi, with the exception of *S. fimbriatum*, utilized glucose in considerable quantities. The different fungi varied greatly in the amount of glucose they consumed at the same concentration. In general, the greatest consumption was in the weaker solution (10 per cent) and decreased progressively with the increase of concentration. With two exceptions, all the organisms grew in

solutions containing from 42 to 50 per cent of glucose. *Penicillium* sp. alone grew in a 58 per cent solution.

The different organisms varied greatly in the amount of glucose required to produce 1 gm. of dry weight, and likewise, the amount required to produce 1 gm. of dry weight of the same fungus differed with the concentration of the solution. Some of the organisms, particularly *F. acuminatum*, *Sclerotium bataticola*, and *Sphaeronema fimbriatum*, had little or no influence on the hydrogen-ion concentration. On the other hand, the other species increased perceptibly the acidity of the solution.

All of the fungi grew in solutions with a maximum osmotic pressure varying from 81.33 to 101.46 atmospheres. *F. acuminatum* and *M. racemosus* increased the concentration, while the other species in general decreased it. In general, the decrease in the osmotic concentration was found to be not in proportion to the sugar consumed. It is considered possible that compounds such as organic acids, alcohol, etc. were formed from the sugar which would themselves influence the osmotic concentration.

Respiration of sweet potato storage-rot fungi when grown on a nutrient solution, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 211–226, fig. 1*).—In continuation of the above investigation the authors report studies on the availability of glucose as a source of carbon for fungi and upon the amount of carbohydrate used in respiration as measured by the amount of carbon dioxid given off.

All of the fungi, with the exception of *Sphaeronema fimbriatum*, were found able to utilize glucose as a source of carbon. *Penicillium* sp., *Botrytis cinerea*, and *Scelerotium bataticola* produced a maximum of a little more than 2 gm. of carbon dioxid a day. The other fungi formed a relatively small amount.

Three species, *Penicillium* sp., *B. cinerea*, and *S. bataticola*, grew slowly but produced a relatively large amount of dry material and consumed all, or nearly all, of the glucose.

The authors found that the quantity of carbon dioxid evolved was not necessarily correlated with the amount of glucose reduced, nor did the quantity appear to be the equivalent of the theoretical amount that might have been produced from the sugar consumed. The authors claim to have demonstrated for the first time that alcohol is produced by *Fusarium acuminatum*, *Rhizopus tritici*, and *Diplodia tubericola* under the conditions of the experiment.

The present status of the tobacco blue-mold (Peronospora) disease in the Georgia-Florida district, E. F. SMITH and R. E. B. MCKENNY (*U. S. Dept. Agr., Dept. Circ. 181 (1921), pp. 4*).—In order to correct some inaccurate statements regarding the occurrence of this disease of tobacco, the authors state that, so far as known, the disease seems to be confined to the region in which it was first reported (E. S. R., p. 247), and that it has not appeared in Connecticut, North Carolina, nor, so far as the authors are informed, in other districts of Florida or in southern Alabama.

Warning to tobacco growers, E. H. JENKINS (*Conn. State Sta. Bul. Immed. Inform. 15 (1921), pp. 2*).—Attention is called to "wild fire," a bacterial disease of tobacco, and suggestions are given for the treatment of seed beds and young plants for the prevention of the disease.

Plant sanitation in fruit plantations, F. T. BROOKS (*Brit. Mycol. Soc. Trans., 6 (1919), pt. 3, pp. 253–262*).—The author deals illustratively with various facts, principles, means, and methods relative to the production of ideal fruit on a commercial scale.

The ammonium polysulphid wash, J. V. EYRE, E. S. SALMON, and L. K. WORMALD (*Jour. Bd. Agr. [London], 26 (1919), No. 8, pp. 821, 822*).—Ammonium polysulphid wash, found to be efficacious against the Erysiphaceae, is deemed particularly useful for spraying such parts of plants as fruits, since it leaves no visible deposit on drying.

As a result of investigations carried out at the Southeastern Agricultural College at Wye, it has been found that the fungicidal strength of the ammonium polysulphid wash can be accurately determined by ascertaining the percentage of the polysulphid sulphur that it contains. Investigation during the winter of 1918–19 developed a method for making a stable concentrated solution containing as much as 21.9 per cent of polysulphid sulphur. Such a solution, when made up with water 1:99, proved to be fungicidal for the powdery conidial stage of mildews. It is pointed out, therefore, that three formulas are now available by which the concentrated ammonium polysulphid solution can be made, viz, one which can be diluted 1:20; the 1918 solution (E. S. R., 41, p. 751), to be diluted 1:100; and the 1919 preparation to be diluted 1:200. The preparation of the last mentioned solution is described.

The cause and prevention of the fire blight, C. W. MICHEL (*So. Dak. State Hort. Soc. Ann. Rpt., 14 (1917), pp. 181–185*).—Brief discussion is given of the character, early known history, life history, and control of fire blight, which is considered perhaps the most destructive disease of fruit trees, attacking pears, apples, and other pomaceous fruits. Resistant varieties and protective measures are indicated.

Peach leaf curl [in Great Britain] (*Jour. Bd. Agr. [London], 26 (1919), No. 8, pp. 823–825*).—Peach leaf curl (*Exoascus deformans*), known in this region for more than a century and very destructive in certain seasons to peaches and nectarines, also more rarely to almonds, is much less prevalent on trees grown under glass than in the open. A description of symptoms is given with directions for control, which is said to be effectual when either Bordeaux or Burgundy mixture is applied before the buds begin to swell in the spring.

A supposed nematode disease of bananas, W. NOWELL (*West Indian Bul., 17 (1919), No. 3, pp. 177–179*).—In May, 1918, a serious disease in Grenada of the bluggoe banana, used extensively as temporary shade for cacao, was recognized. An account is given of the characters, nature, and incidence of the disease, which is ascribed to a nematode, of which a description by Cobb is noted below.

A new nema said to cause a serious affection of the bluggoe banana in Grenada, British West Indies, N. A. COBB (*West Indian Bul., 17 (1919), No. 3, pp. 179–182, figs. 2*).—The nematode attacking bananas as noted above is described under the name of *Tylenchus musicola* n. sp., with discussion of closely related forms.

Some relations of temperature to growth and infection in the citrus scab fungus Cladosporium citri, H. S. FAWCETT (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 243–253*).—In a contribution from the Citrus Experiment Station, Riverside, Calif., the author reports experiments to determine the influence of temperature on scab infection on young sour-orange leaves and on the growth and spore formation of the causal organism.

The conditions found necessary for scab infection were (1) viable spores of the fungus, (2) young citrus leaves of a susceptible species, (3) moisture, and (4) temperatures between 16° and 23° C. The limited range of temperature at which infection of a susceptible host took place under the presumably favorable conditions of the experiment is believed to explain the great differences observed in the occurrence and severity of scab from year to year and from season to

season in citrus orchards. It is also believed to explain the differences reported in results of previous inoculation experiments.

Coffee root rot, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 32 (1920), Spanish ed., pp. 5–10, figs. 2*).—A popular description is given of diseases of coffee due to *Rosellinia* sp.

Damping-off in forest nurseries, C. HARTLEY (*U. S. Dept. Agr. Bul. 934 (1921), pp. 99, pl. 1, figs. 20*).—The results are given of an investigation on the causes of damping-off in forest nurseries and of methods for the control of this trouble. Damping-off in nurseries is claimed to be caused mainly by seedling parasites which are not specialized as to host, and as a result of the author's investigations *Pythium debaryanum*, *Corticium vagum*, and *Fusarium* spp. were found to be of probably equal importance. The damping-off of conifers appears to be due principally to these species. Investigations were made as to the susceptibility of 63 species of coniferous seedlings, and it was found that some which were especially susceptible in some nurseries were quite resistant in other localities.

For the control of damping-off the best method thus far tested is the disinfection of the seed-bed soil before or immediately after the seed is sown. Sulphuric acid has been found very useful for the preparation of seed beds for coniferous seedlings.

The results are given of inoculation experiments with a considerable number of fungi found occurring in connection with the growth of seedling trees, showing that thick sowing favors the disease and that soil acidity is, in general, unfavorable to damping-off.

A list of 147 references to cited literature is appended.

Snow breakage and top rot in fir, T. LAGERBERG (*Meddel. Statens Skogsförsöksanst., No. 16 (1919), pt. 5, pp. 115–162, figs. 11*).—Top rot is practically a constant accompaniment of snow breakage in fir forests. It usually develops quickly, particularly in cases of rapidly growing trunks. Stems over 10 cm. (3.9 in.) in diameter often suffer severely. Resin flow and growth may hinder the progress of the rot, and in exceptional cases may stop it entirely.

Corticium evolvens on fir wood, T. LAGERBERG (*Skogsvårdsför. Tidskr., 18 (1920), No. 7–8, pp. 149–167, figs. 4*).—Tabular data and discussion shows the relation of *C. evolvens* to growth in fir.

[Mistletoes and their hosts], C. VON TUBEUF (*Ztschr. Pflanzenkrank., 27 (1917), No. 5–6, pp. 241–287*).—This is a systematic account, including infection studies, of mistletoes on evergreen and deciduous trees.

A drain-blocking fungus, A. L. SMITH (*Brit. Mycol. Soc. Trans., 6 (1919), pt. 3, pp. 262, 263*).—*Fomes ulmarius* was found to have formed a mass weighing about 50 lbs., partly closing a London drain pipe, though no elm was growing in the neighborhood. The fungus was found in four different places and might have lived on coniferous wood found in the vicinity.

Control of root knot, II, J. R. WATSON (*Florida Sta. Bul. 159 (1921), pp. 29–44, fig. 1*).—In continuation of previous publications (E. S. R., 37, p. 453), the author gives additional information regarding the control of root knot due to nematodes. Comments are given on the susceptibility of different host plants and on various methods of control. Root knot was controlled by an application of sodium cyanid solution followed immediately by an application of ammonium sulphate. This method, although probably too expensive for field use, is recommended for the treatment of seed beds, particularly for such plants as are started in the late summer or early fall when nematodes are most active.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Annual report of the Governor of Alaska on the Alaska game law, 1920, T. RIGGS, JR. (*U. S. Dept. Agr., Dept. Circ. 168 (1921), pp. 18*).—Appended to this report on the status of game and fur-bearing animals and migratory and nonmigratory birds are lists of hunting licenses, special moose-shipping licenses, and general game-shipping licenses issued during the year, and game or trophy shipped from Alaska for private use.

Sixth annual list of proposed changes in the A. O. U. Check List of North American birds, H. C. OBERHOLSER (*Auk, 38 (1921), No. 2, pp. 264–269*).—This list is in continuation of those previously noted (E. S. R., 42, p. 847; 43, p. 50).

Mutanda ornithologica, IX, X, H. C. OBERHOLSER (*Biol. Soc. Wash. Proc., 33 (1920), pp. 83, 84; 34 (1921), pp. 49, 50*).—A continuation of papers previously noted (E. S. R., 42, p. 249).

The migration of North American birds, X–XV, compiled by H. C. OBERHOLSER (*Bird Lore, 21 (1919), Nos. 3, pp. 170, 171; 6, pp. 354, pl. 1; 22 (1920), Nos. 2, pp. 90, 91, pl. 1; 4, pp. 213–216; 6, pp. 343–345; 23 (1921), No. 2, pp. 78–82*).—These papers, in continuation of those previously noted (E. S. R., 40, pp. 254, 646; 41, p. 547), record the migration of the blue jay, Steller's jay, and green jay; Canada jay, Oregon jay, Clarke's nutcracker, and piñon jay; Arizona jay, California jay, and their allies; the European starling and bobolink; cowbirds; and yellowheaded blackbird and meadowlarks, respectively.

A list of the birds of Royal Palm Hammock, Fla., A. H. HOWELL (*Auk, 38 (1921), No. 2, pp. 250–263*).

Food habits of Sceloporus graciosus graciosus (Baird and Girard), H. J. PACK (*Biol. Soc. Wash. Proc., 34 (1921), pp. 63–66*).—Identifications made of the stomach contents of above 70 specimens of the common sagebrush swift, collected in the vicinity of Salt Lake City, Utah, are recorded in tabular form. The results substantiate the common belief that this lizard is insectivorous and beneficial, the red-legged locust having been its chief item of food.

Observations on the insect fauna of permanent pasture in Cheshire, H. M. MORRIS (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 141–155, fig. 1*).—"An area was chosen which was as typical as possible of the permanent pasture fields of the district, and in which invasion by insects not belonging to the area would be reduced to a minimum. In order to define the characters of the area under consideration as clearly as possible, chemical, mechanical, and botanical analyses were carried out.

"Insects, largely in immature forms, were obtained by examining samples of soil from various parts of the area, and in addition many adults were obtained by sweeping the herbage with a net. The latter method produced also some invading forms which did not belong to the area. The factors influencing the distribution by depth of the insects in the soil were in this case chiefly occurrence of food, aeration, and moisture, and the result of these influences was that the insects seldom penetrated even as deep as 6 in., the vast majority of specimens being found at a depth not greater than 2 in.

"The census of insects actually found in the samples of soil gave an insect population of 3,586,088 per acre. The family best represented in number of individuals was the Bibionidae, species of which made up 32.4 per cent of the total number of soil insects. The next in number were the Mycetophilidae, 16.7 per cent, and the Staphylinidae, 12.2 per cent. With regard to number of species occurring in the soil, the Coleoptera, with 29 species, was the best represented order."

Entomological drawings and draughtsmen: Their relation to the development of economic entomology in the United States, W. R. Walton (*Ent. Soc. Wash. Proc., 23 (1921), No. 4, pp. 69–99*).

The use of gas-tight fumigation covers, H. J. Quayle and H. Knight (*Calif. Citrogr., 6 (1921), No. 6, pp. 196, 228, figs. 2; also in Calif. Cult., 56 (1921), No. 12, pp. 381, 384, 385*).—This article is based upon work with gas-tight tents, by the senior author, since 1914. It is pointed out that with the use of gas-tight covers the dosage for small trees may be reduced two-thirds, for average sized trees one-half, and for large trees one-fourth, making an average for all trees of about 50 per cent of the schedules now in use. With this reduction in dosage the period of exposure may also be reduced to about 30 minutes to effect results as good as, or better, than those now secured with canvas tents.

"Wind (unless a strong wind) does not interfere with fumigation with gas-tight tents, and the results are not impaired, as is the case even in a slight wind with canvas tents. Humidity or moisture does not increase the injury to the tree, because the gas-tight tent does not vary in gas-holding capacity. The tents also dry more quickly . . . It is possible to determine a constant or dosage for each scale that will apply to any particular district.

"Greater safety from injury to the tree and fruit, because there is less variability in dosage, is insured with gas-tight tents. (This does not apply to work done in sunlight.) With rubberized gas-tight cloth the patching and repair work on tents is easily and quickly done in the field. With the reduction in amount of hydrocyanic acid required, the use of gas-tight covers should eventually reduce the cost of fumigation to the grower."

A volumetric schedule for gas-tight tents, prepared by the senior author, is presented.

The application of vacuum fumigation to fresh and packed dates, D. B. Mackie (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 321–324, figs. 2*).—The successful use of a vacuum fumigator for the control of insects infesting dates, particularly the Indian-meal moth and the saw-toothed grain beetle (*Sylvanus surinamensis*), is described.

Eighteenth annual report of the State entomologist of Montana, R. A. Cooley (*Montana Sta. Bul. 139 (1921), pp. 16, figs. 2*).—In discussing current entomological problems, the author deals with grasshoppers; the pale western cutworm, a circular relating to which has been previously noted (E. S. R., 44, p. 757); the fruit-tree leaf-roller [(*Archips*) *Cacoecia argyrospila*]; the alfalfa weevil; and the sugar-beet webworm (*Loxostege sticticalis*). The report concludes with brief notes on other insect pests of the year 1920.

Report of the imperial entomologist, T. B. Fletcher (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 68–94, pls. 7*).—Reporting upon work with borer pests of rice, it is stated that rice stubble in Bengal and Bihar showed a large percentage of infestation by borers, of which *Schoenobius bipunctifer* was the most important, followed by *Chilo simplex*, although *C. oryzae* and *Sesamia inferens* were also implicated. Work with insects of cotton, sugar cane, and mulberry, and with fruit pests, stored grain pests, bees, lac, and silkworms, and life histories of insects are also reported upon.

The Report of the Imperial Pathological Entomologist, by the late F. M. Howlett (pp. 95–108), follows.

Work of the division of entomology, J. F. Illingworth (*Ann. Rpt. Queensland Bur. Sugar Expt. Stats. Ann. Rpt., 20 (1920), pp. 34–39*).—This report relates in large part to work with the grub pest of sugar cane. Other important species mentioned include *Lepidiota albohirta* Waterh., *L. frenchi* Blackb., and *Rhabdocnemis obscura* Boisd.

Some new Orthoptera from Mokanshan, China, A. N. CAUDELL (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 27–35, figs. 2*).—Two new genera are erected and six species described as new.

Revision of the genus Lygaeus Fab. (Hemiptera-Heteroptera), H. G. BARBER (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 63–68*).

The mouth parts of the cicada, R. E. SNODGRASS (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 1–15, figs. 15*).

Notes on the periodical cicada in 1919, R. A. ST. GEORGE (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, pp. 227–231*).—This is a report of observations on the 1919 emergence of brood X of the periodical cicada made at Falls Church, Va., and vicinity. The relation of phenological events in plants and cicada is considered.

Periodical cicadas in Baltimore, Md., E. A. ANDREWS (*Sci. Mo., 12 (1921), No. 4, pp. 310–320*).—This account is based upon observations made during the early summers of 1902 and 1919, particularly the latter year.

Summer control of the chinch bug, J. W. MCCOLLOCH (*Kansas Sta. Circ. 87 (1921), pp. 8, figs. 3*).—This circular deals with dust and oil barriers and their use and operation in Kansas, where, after an absence of six years, this pest has again made its appearance in damaging numbers.

The smallest known leafhopper [Empoasca minuenda n. sp.], E. D. BALL (*Biol. Soc. Wash. Proc., 34 (1921), pp. 23, 24*).—The author describes a minute pale leafhopper found by Moznette to attack the avocado at Miami, Fla.

The life history and successful introduction into California of the black scale parasite, Aphycus lounsburyi How., H. S. SMITH and H. COMPERE (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 310–320, figs. 5*).—This is an account of a parasite which was successfully introduced into California from Australia in shipments of black scale material. Up to the time of writing 30,000 specimens had been liberated in various demonstration plats; the species had become acclimated, and was rapidly increasing in numbers.

Technical descriptions are given of the male and female, and studies of its life history and habits are reported on.

The genus Matsucoccus with a new species, F. B. HERBERT (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 15–22, figs. 10*).—Included in this paper is a description of *M. acalyptus* n. sp. taken from *Pinus monophylla* from southern Idaho.

Studies in North American Cleorini (Geometridae), J. H. MCDONNOUGH (*Canada Dept. Agr., Ent. Branch Bul. 18 (1920), pp. 64, figs. 124*).—In this bulletin the author deals with representatives of 23 genera, 14 genera being erected and 2 given new names.

The corn earworm as an enemy of vetch, P. LUGINBILL and A. H. BEYER (*U. S. Dept. Agr., Farmers' Bul. 1206 (1921), pp. 19, figs. 13*).—This is a popular summary of information on the bollworm as an enemy of vetch, and means for its control. An account of this pest, by the senior author, has previously been noted (E. S. R., 39, p. 764). The pest is the most serious one that growers of vetch have to combat, since the caterpillars eat both the foliage and the seed pods and, if infestation is heavy, make the crop practically worthless. Where intended for a hay crop the vetch usually escapes serious injury, as it is cut before the caterpillars are large enough to do much damage. Spraying, dusting, the use of poisoned-bran bait, and other control measures are discussed.

A recently discovered citrus pest, Platynota tinctana (Walk.) in California, R. S. WOGLUM (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 341–343*).—Injury to oranges from short burrows in the rinds, frequently leading to

decay, which is familiar to most packing-house managers and to many growers in southern California and has been generally attributed to the orange tortrix (*Tortrix citrana*), has been found to be due to a species identified as *P. tinctana* Walk.

The larva of Popillia japonica Newm. and a closely related undetermined ruteline larva, a systematic and morphological study, A. G. Böving (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 51–62, figs. 27*).

Synonymical note in Aecophoridae, C. Heinrich (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, p. 232*).

Anaphoidea conotracheli Gir. (Hym.), an egg parasite of the apple maggot, B. A. Porter and C. H. Alden (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 62, 63*).—This common mymarid parasite of the egg of the plum curculio on various fruits in many localities and also reared from the egg of the grape curculio (*Craponious inæqualis* Say) has been found by the authors to parasitize the eggs of the apple maggot at Wallingford, Conn. Counts made of material collected at that place gave percentages of parasitism ranging from 25 to 30 per cent, indicating that it may prove of great importance in the control of the apple maggot.

A new genus of Bombyliidae, C. T. Greene (*Ent. Soc. Wash. Proc., 23 (1921), No. 1, pp. 23, 24, fig. 1*).—The genus Calopelta is erected for the new species *C. fallax*, from Fort Garland, Colo.

Another anomalous dipteron added to the Rhyphidae, R. C. Shannon (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, pp. 50, 51*).

Description of a new genus of Nemocera, W. L. McAtee (*Ent. Soc. Wash. Proc., 23 (1921), No. 3, p. 49*).

Frit fly (Oscinis frit) in relation to blindness in oats, A. Roebuck (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 178–182, pl. 1*).—"From the abundance of evidence obtained last summer I feel justified in suggesting that there may be three broods of frit flies on the oat crop, and that 'blindness' [blind spikelets in the panicles] is caused by the intermediate one. Probably only a certain percentage of the intermediate brood cause this 'blindness,' the remainder entering newly forming tillers. Perhaps the scarcity of suitable tillers, in view of the more advanced condition of the crop and the consequent lessening of the light at the base, compels a certain number to choose the next most suitable site, with the results shown. Exact information on this matter, however, is not available.

"Another site for this brood found in some abundance during 1917 was on the stems of winter wheat. The larvæ were feeding on the stems from the base to at least the third node up, and the pupæ were found in the leaf sheath anywhere between the node and the ligule."

The larvae of the Coccinellidae, J. H. Gage (*Ill. Biol. Monog., 6 (1920), No. 4, pp. 62, pls. 6*).—This paper relates to the morphology (pp. 9–26) and a synopsis of the coccinellid larvae (pp. 27–47). A bibliography of 21 titles is included.

Larva of the North American beetle Sandalus niger Knoch, F. C. Craighead (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 44–48, figs. 8*).

The structure, bionomics, and economic importance of Saperda carcharies L., "the large poplar longhorn," W. Ritchie (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 299–343, pls. 3, figs. 25*).—This is a report of studies of one of the three species of Saperda occurring in Great Britain, of which but two, *S. carcharias* and *S. populnea*, are of economic importance.

S. carcharias attacks vigorously growing, healthy poplar between the ages of 5 and 20 years. *Populus tremula*, which is chiefly an ornamental species is its principal host, but in the absence of this host, or on a sudden increase of

the numbers of the pest, other valuable timber-producing poplar species may be endangered. A list is given of 18 references to the literature.

The green June beetle or fig eater, J. J. Davis and P. Luginbill (*North Carolina Sta. Bul. 242 (1921), pp. 3–35, figs. 9; appendix, pp. 8, pls. 3, figs. 6*).—This summary of the present status of knowledge of (*Allorhina*) *Cotinis nitida* L. includes a report of investigations of its life history, habits, and economic status at Columbia, S. C., Louisville, Ky., and Lafayette, Ind.

The adult beetles are frequently reported as injurious to fruit of various kinds, but the grubs are seldom directly injurious to vegetation. Indirectly the grubs may considerably damage garden and field crops, as well as lawns and meadows, by their tunneling and burrowing, uprooting young tender plants, as well as causing the ground to become porous. Lawns are sometimes disfigured and made unsightly by the tunneling of the grubs and by hills of earth thrown up. Instances of injury by the beetle and grubs are given. The species is generally distributed east of the Mississippi River and as far north as St. Louis and Cincinnati in the Mississippi and Ohio valleys and somewhat farther north along the Atlantic coast.

The life cycle of this species is completed in just one year. The adults appear from the last week of June through August, and eggs are deposited soon after their appearance, preferably in soil which has been heavily manured. They hatch ordinarily in two or three weeks. Upon hatching, the grubs tunnel through the soil, feeding on humus, and have a peculiar habit of running their burrows to the surface of the ground, from the open exit of which they throw out little piles of earth resembling ant hills. They continue to feed until cold weather sets in, by which time they are at least two-thirds grown. They do not become completely dormant during the winter, at least not south of latitude 38.5°. Feeding begins as soon as spring opens, and their growth is completed by June, after having molted twice. They then prepare brittle earthen cells within which to pupate, and the first beetles emerge about the last of June or the first of July.

The digger wasp *Scolia dubia* Say is a common parasite of the grubs of this beetle in some localities and materially assists in control of the pest. Three sarcophagid flies have been reared from *C. nitida*, namely, *Sarcophaga sarraceniae* Riley and *S. helicis* Towns. from the adult and *S. utilis* Ald. from partially formed pupae. The mite *Macrocheles marginatus*, the green muscadine fungus (*Metarrhizium anisopliae*), and a bacterial disease caused by *Micrococcus nigro-fasciens* are said to attack it, and numerous birds are listed as feeding upon it.

In discussion of control measures it is stated that in tests made at Louisville, Ky., 80 per cent of the grubs in golf grounds treated with an 8 to 10 per cent kerosene emulsion were killed by a single application, made at the rate of about 1 gal. to 6 or 8 sq. ft. and afterwards thoroughly washed into the soil by copious sprinkling with water.

"Emulsifiable coal tar preparations, which are essentially composed of coal tar oils, phenols, and a saponifying agent, have given very good results against this grub, slightly less effective than kerosene emulsion, but as cheap and much more easily prepared since they readily mix with water. The results of the application of the coal tar products are more evident, since a larger percentage of the grubs come to the surface before succumbing to the action of the insecticide. We find the insecticide appreciably more effective if an additional light sprinkling of it is made after the grubs come to the surface. A material analyzing, approximately, phenols 12 per cent, coal tar oils 53 per cent, water 10 per cent, saponifying agent 25 per cent, should be diluted one part to 125

parts of water and applications and subsequent sprinkling with water should be made as in the use of kerosene emulsion."

Carbon bisulphid is said to be a thoroughly reliable remedy and especially useful on putting greens, but it requires more labor than the other insecticides mentioned. Collecting the beetles is said to have been practiced in some localities. It is recommended that in places where injury is likely to occur chemical fertilizers be used in place of animal manures.

An annotated bibliography of five pages, chronologically arranged, is included. The appendix contains several corrections to the bulletin.

Bionomics of weevils of the genus Sitones injurious to leguminous crops in Britain, D. J. JACKSON (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 269–298, pls. 5, figs. 6*).—The present paper consists of a detailed report of studies of *S. lineatus* L., the adults of which do their pricipal damage to peas and beans when the plants are from 3 to 6 in. high by feeding upon the leaves, while the larvæ are a source of injury to the root nodules of peas and beans, their injury attaining its maximum at the commencement of the flowering season. The paper includes a brief account of its natural enemies, a key to the 14 British species of Sitones found on leguminous crops, and a bibliograph.

The "piche" or sweet-potato weevil, J. D. MORE (*Porto Rico Dept. Agr. and Labor Sta. Circ. 34 (1921), Spanish ed., pp. 3–6, pl. 1*).—This is a brief popular account of *Cylas formicarius* Fab., with control measures.

Agentine ant control from an economic standpoint, A. F. SWAIN (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 333–338, fig. 1*).—It is pointed out that by the use of poisoned bait the Argentine ant can be controlled under citrus orchard conditions in southern California at a cost of possibly only 1.25 cts. per tree per year. "The ant is a prime factor in the Riverside district in the abundance of the soft brown scale and has necessitated the great expense of fumigation, which is several times greater than the cost of ant control. It is also a prime factor in the abundance and spread of the Citrophilus mealy bug, which is potentially a very serious orchard pest. The loss in efficiency of labor due to the ant is greater than the cost of ant control."

On the identity of several species of Chalcidoidea (Hymenoptera), A. B. GAHAN (*Ent. Soc. Wash. Proc., 22 (1920), No. 9, pp. 235–243*).

Dipterous parasites of sawflies, C. T. GREENE (*Ent. Soc. Wash. Proc., 23 (1921), No. 2, pp. 41–43*).—The author has here brought together all the records he has been able to find on this subject, and has added some new breeding records.

FOODS—HUMAN NUTRITION.

The distribution of enzyms and proteins in the endosperm of the wheat berry, F. J. MARTIN (*Jour. Soc. Chem. Indus., 39 (1920), No. 23, pp. 327T, 328T*).—A study is reported of the nature and extent of the variations in flour from different parts of the wheat berry with respect to enzymic activity and quantity and quality of flour. A single wheat, Barusso Plate, was milled for this experiment, and four samples of reduction flour from different parts of the grain, two of break flours, and one of straight grade flour representing the entire endosperm were used. The enzymic activity was measured by the amount of gas the flour was capable of producing in 24 hours when fermented with a given amount of yeast. Gluten was determined wet and dry after washing out the starch. The gas-retaining capacity of the gluten was determined by measuring the volume of doughs containing identical amounts of gluten from the different sources. Confirmatory baking tests with the different flours were also made. The results obtained are summarized as follows:

"The enzymic activity, as shown by the evolution of carbon dioxid on fermentation, increases progressively from the interior to the exterior of the endosperm. The quantity of gluten increases in the same manner. The quality of the gluten varies considerably, being good in flour from the interior of the endosperm and deteriorating progressively in flour from regions approaching the cortex. The effect of the combination of the increasing quantity with decreasing quality of gluten tends to produce flours of a common 'strength' from various parts of the wheat berry."

An experimental study of the effect of certain organic and inorganic substances on the bread-making properties of flour and on the fermentation of yeast, H. MASTERS and H. MAUGHAN (*Biochem. Jour., 14 (1920), No. 5, pp. 586–602*).—The authors have investigated the effect of certain organic and inorganic substances on the bread-making properties of flour. The samples of flour represented, in addition to wheat flour of 80 per cent extraction, the various combinations of wheat flour of from 75 to 90 per cent extraction with barley, rice, maize, and rye flours which were used in England during the war. The baking experiments included studies of the effect of the addition of lime water, of alternate reduction and increase in the atmospheric pressure on the expansion of the gluten and of the addition of ox serum, phosphates, and potato alone or combined. Measurements were also made of the amount of fermentation produced by yeast with the various ingredients in the absence of flour and also of the expansion of the dough prior to baking.

The addition of lime water, while neutralizing any acidity in the flour, did not prevent the production of acid and tended to decrease the size of the loaf. It was found impossible to alter the final size of the loaf by stretching the dough through alternate increase and decrease in pressure in a vacuum desiccator.

Fresh ox serum added in 1 per cent concentration caused a marked increase in the volume of the loaf. This property of the serum was found to diminish rapidly on keeping, but was not destroyed by heating to from 50 to 60° C. Gelatin, egg, and blood albumin, caseinogen and lime water, and gelatin alone did not prove satisfactory as substitutes for the ox serum. The addition of phosphates tended to increase the size of the loaf, the maximum increase occurring on the addition of 1 part of monosodium dihydrogen phosphate to 200 parts of the flour. Neither phosphate nor serum produced any increase in the size of the loaf when the bread was raised with chemical raising agents.

In the baking tests with varying proportions of potato, cooked and raw, the best results as to size, texture, etc., were obtained with a mixture containing boiled potato equivalent to from 25 to 33 per cent of the total weight.

The experiments on fermentation of the yeast with the various ingredients whose effect on the properties of the bread was studied in the first part of this investigation and measurements of dough expansion were in general in agreement with the baking experiments, an exception being the results obtained with potato. Raw potato stimulated the action of the yeast to a greater extent than boiled potato, but a larger loaf was obtained with the boiled potato than with raw.

Further work on the bacteriology of swelled canned sardines, W. SADLER, I. MOUNCE, and E. SHANLY (*Roy. Soc. Canada Proc. and Trans., 3. ser., 13 (1919), Sect. V, pp. 135–141*).—This paper, supplementing a previous report (E. S. R., 40, p. 864), deals with an investigation of the possible sources of the bacteria causing the swelling of cans of sardines. Cultural studies were made from the intestines and gills of herrings obtained from weirs, fishing smacks, and canneries along the Atlantic coast from the biological station at St. Andrews, N. B., as a center. Samples were also taken from the water and mud of

the weirs and from the water used for the pickling before and after the herrings had been put in.

From material from each of these sources 10 strains of gas-producing bacteria were isolated. These could be classified in three groups, consisting of types of *Bacillus vulgaris*, liquefying gelatin but not fermenting lactose to gas; types of *B. acidi lactici*, *B. aerogenes*, *B. coli*, and *B. communior*, which do not liquefy gelatin but which ferment lactose to acid and gas; and types of the *p*-Gaertner group, which do not liquefy gelatin nor ferment lactose to acid and gas but which produce acid and gas in glucose.

Special attention is called to the observation that without exception the cultures isolated from the intestines of the herrings gave an acid reaction to methyl red, while all the cultures isolated from water in the weirs were alkaline to methyl red.

Twenty-fifth report on food products and thirteenth report on drug products, E. M. Bailey (*Conn. State Sta. Bul. 227 (1921), pp. 217–283*).—The results of inspection and analysis of foods, drugs, and miscellaneous materials reported, include, among other articles, carbonated soft drinks and similar goods, breakfast foods, "health foods," flour, cocoa, coffee, desiccated products (clam broth, soups, rice pudding, roast beef hash, corned beef hash, and a Welsh rabbit product), diabetic foods, egg shells, egg powder, egg noodles, dehydrated eggs, fats and oils, ice cream, milk and milk products (market milk, cream, a so-called "super-cream," "Imitation Milk" made from skim milk and coconut fat, milk powders, malted milk, and human milk), sirups, tea, and vinegar.

The report on the inspection of soaps includes a discussion of some questions of soap and soap making and of analytical methods.

[Vitamins] (*N. Y. State Jour. Med., 20 (1920), No. 7, pp. 209–225, figs. 4*).—This symposium on vitamins at the annual meeting of the New York State Medical Society on March 24, 1920, consisted of papers on The Antiscorbutic Vitamin, by A. F. Hess (pp. 209–211); The Fat-soluble Vitamin, by L. B. Mendel (pp. 212–217); and The Water-soluble Vitamin, by T. B. Osborne (pp. 217–222), with discussion by E. V. McCollum, C. Funk, L. E. Holt, G. Lusk, and J. Lewi.

The vitamin content of honey and honeycomb, P. B. Hawk, C. A. Smith, and O. Bergeim (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 2, pp. 70, 71*).—This is a brief note of an investigation of the vitamin content of white clover honey in the comb and of a mixed strained honey. Rats fed on a diet lacking in vitamin B, and others on the same diet in which half of the carbohydrate had been replaced by an isodynamic equivalent of either of these honeys, showed in five weeks an average gain of only 5 gm. in favor of the honey-fed rats. This indicates the presence of a small but negligible amount of vitamin B, a result in agreement with the previously reported conclusions of Dutcher in regard to the antineuritic vitamin in honey as tested on pigeons (E. S. R., 40, p. 564).

The addition of strained honey to diets deficient in A did not induce growth. The addition of comb honey caused distinct gains in weight, indicating the presence of A in the honeycomb.

The addition of 20 per cent of honey to the scorbutic diet of guinea pigs did not prevent or appreciably delay the onset of scurvy, the results thus confirming those of Faber (E. S. R., 44, p. 63).

The effect of heat and age upon the antiscorbutic vitamin in tomatoes, M. H. Givens and H. B. McClugage (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, p. 164*).—As a further contribution to the value of the tomato as an antiscorbutic agent (E. S. R., 40, p. 762), the authors report that guinea pigs are

protected against scurvy by daily doses of 2.5 gm. of fresh raw tomatoes, by 10 gm. of fresh raw tomatoes heated 1 hour at 100° C., by 2 gm. of dried tomatoes heated 15 minutes at 100°, by 10 gm. of tomatoes canned at 15 lbs. pressure for 30 minutes, by 3 cc. of commercial canned tomatoes 3 years old, and by 10 gm. of commercial canned tomatoes, 3 years old, cooked 15 minutes at 100°.

Studies in the physiology of vitamins: Is water-soluble vitamin identical with secretin? G. R. COWGILL (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, pp. 148, 149*).—This is a brief note of experiments undertaken to throw more light on the question of the possible identity of vitamin B with secretin as suggested by Voegtlin and Myers (E. S. R., 44, p. 765) and others.

A number of extracts which had been tested for vitamin B on polyneuritic pigeons and on dogs which had lost their appetite following a diet lacking in B, were tested for their effect on the flow of pancreatic juice and bile in anesthetized dogs in which the pylorus and the cystic duct were ligated to prevent secretion due to discharge of acid chyme and gall-bladder bile. Extracts of rice polish, wheat embryo, navy bean, yeast, and neutralized tomato juice were tested. Except in the case of tomato juice all of these products gave negative results, while fresh secretin solution in comparatively small amounts injected as controls produced a characteristic and vigorous flow of pancreatic juice and bile.

Preliminary experiments with the fat-soluble vitamin (vitamin A), H. C. SHERMAN, F. L. MACLEOD, and M. M. KRAMER (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 2, pp. 41–43*).—This is a preliminary note concerning investigations which are being conducted at the senior author's laboratory on vitamin A in regard to its distribution between the fatty and aqueous phases of milk, significance in growth and reproduction, storage in the body, and heat destruction.

That skim milk contains an appreciable amount of vitamin A has been shown by the satisfactory growth of young rats placed at weaning upon a diet in which dried skim milk was the sole source of vitamins, the restoration of growth and recovery from the characteristic eye disease due to lack of A on the addition of this skim-milk powder to the deficient dietary, and the rapid growth of young rats when white bread which had brought about failure of growth was supplemented by the skim-milk powder.

The experimental results already obtained indicate that the proportion of vitamin A in the food may have quite as striking an influence upon reproduction as upon growth, that the surplus of the vitamin over and above the immediate needs for growth or maintenance is largely stored in the body, and that the vitamin is only very slowly destroyed by dry heating at a temperature of 100° C. with free access of air. "The results thus far obtained emphasize the importance of taking full account of the time as well as the temperature of heating, and of the initial concentration of the vitamin in the food, as well as of the opportunity for previous storage of the vitamin by the test animal."

The cultivation of yeast in solutions of purified nutrients, M. B. MACDONALD and E. V. MCCOLLUM (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 307–311*).—The authors report that they have succeeded in securing the multiplication of three strains of yeast (two baker's and one brewer's) in 15 successive seeds in nutrient solutions of purified chemical substances without the addition of any growth-promoting substance. Quantities of yeast thus grown have been sufficient to furnish from 2 to 5 gm. of dry substance. Two solutions were used, the first consisting of recrystallized sucrose 20, ammonium sulphate 3,

potassium dihydrogen phosphate 2, calcium chlorid 0.25, and magnesium sulphate 0.25 gm., dissolved in 1 liter of distilled water. The second solution differed from the first only in that it contained 50 gm. of sucrose per liter. The reagents used were all C. P., and the solutions were sterilized by heating to boiling on two successive days.

The results obtained are thought to indicate that yeast must grow without a specific growth promoting substance, the so-called "bios" or vitamin B, or that it must synthesize the substance to meeet its own needs.

The hygienic valuation of some of the fats recently recommended for edible purposes.—I, Biological and pharmacological studies of hardened plant oils (cottonseed, peanut, linseed, and sesame oil) and of unhardened sesame oil, E. Rost (*Arb. Reichsgsndtsamt., 52 (1920), No. 1, pp. 184–209*).—Observations are reported of the digestibility by dogs of various commercial hardened or hydrogenated oils as judged by gain in weight and general appearance of the animals. The author concludes that the fats tested are eminently suited to human consumption.

The relation of cholesterol to intermediary fat metabolism, W. Hueck and L. Wacker (*Biochem. Ztschr., 100 (1919), pp. 84–99*).—Evidence that cholesterol plays an important rôle in intermediary fat metabolism is presented along the following lines, with confirmatory experimental data:

Cholesterol is a constant accompaniment of animal fat. When added to the food the greater part appears as fatty esters after resorption in the blood. The artificial enrichment of the diet in cholesterol results not only in cholesterolemia, but in an increase in the lipoid fractions, particularly in phosphatids containing fatty acids.

Distribution of zinc in the horse, G. Bertrand and R. Vladesco (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 744–746*).—This contribution to the studies of the distribution of zinc in the animal organism consists of determinations of zinc in the various organs, muscle tissue, skin, etc., of the horse, including determinations on the same material from more than one animal in several cases. The zinc was determined by the calcium zincate method on the ash from 5 gm. of the dried material oxidized with concentrated sulphuric and nitric acids.

The tabulated results show that the organs and tissues of the horse contain notable proportions of zinc, from 3 to 36 mg., per 100 gm. of fresh matter and 12 to 98 mg. per 100 gm. of dry matter. The content of zinc was found to vary not only from one organ or tissue to another, but quite as much in the same organs of different animals. These variations are thought sufficient to explain the discordance in results reported on the same classes of organs by Rost and Weitzel (E. S. R., 42, p. 758), Giaya (E. S. R., 45, p. 64), etc.

Newer aspects of some nutritional disorders, A. F. Hess (*Jour. Amer. Med. Assoc., 76 (1921), No. 11, pp. 693–700, figs. 2*).—In this Harvey Society lecture the author discusses deficiency diseases with particular emphasis on scurvy and rickets. It is pointed out, however, that "the harmful effects of food deficiencies should not be associated in our minds essentially or chiefly with specific diseases such as scurvy or rickets, but rather as disorders of nutrition producing slight and manifold disturbances of function." The chief clinical importance of disorders of nutrition is considered to be a tendency to bring about an abnormal condition of the tissues, rendering them more susceptible to the invasion of bacteria or their products. It is pointed out in this connection that the diseases resulting from prolonged undernutrition in Europe during the recent war are difficult of exact interpretation owing to the number of food factors involved.

The effects of inanition upon the adrenal bodies: Preliminary communication, S. VINCENT and M. S. HOLLENBERG (*Endocrinology, 4 (1920), No. 3, pp. 408–410*).—In this preliminary communication the authors note that they have been able to confirm observations of McCarrison (E. S. R., 41, p. 264) that inanition in pigeons causes hypertrophy of the adrenals, and have also found this to be true in dogs and in rats. In pigeons the adrenals doubled in weight after inanition for 15 days and in dogs after a somewhat longer period. In rats the hypertrophy was considerably greater than in pigeons and dogs, even during a shorter period.

Studies on experimental rickets (*Jour. Biol. Chem., 45 (1921), No. 2, pp. 333–348, pls. 4*).—The two papers presented constitute the first of a series of studies on experimental rickets contributed by the departments of chemical hygiene and pediatrics at Johns Hopkins University.

I. *The production of rachitis and similar diseases in the rat by deficient diets*, E. V. McCollum, N. Simmonds, H. T. Parsons, P. G. Shipley, and E. A. Park (pp. 333–341).—In this paper the formulas are given of certain faulty diets, which when fed to young rats result in the development of pathological changes in the osseous system in some cases identical and in others similar but not identical with those found in rachitic children. Eleven of these diets are described, all of which are deficient in vitamin A or calcium or both. Each has been found to produce in young rats disturbances in the growth and formation of the skeleton, but when fed supplemented with purified food additions to make good the specific deficiencies is capable of inducing approximately normal nutrition and skeletal growth. While suggesting that this indicates that the cause of rickets may lie in a deficiency or failure in metabolism of vitamin A or calcium in the food, the authors are as yet unwilling to draw further conclusions than that the etiological factor is to be found in an improper dietetic régime.

II. *The effect of cod liver oil administered to rats with experimental rickets*, P. G. Shipley, E. A. Park, E. V. McCollum, N. Simmonds, and H. T. Parsons (pp. 343–348).—The experiments reported in this paper furnish direct proof that cod liver oil causes calcium salts to be deposited in the bones. Fifteen young rats were placed on two of the experimental diets described in the previous paper, one low in vitamin A and the other low in Ca, Na, and Cl ions as well as in A. After from 50 to 80 days on these diets and when the animals could apparently live but a few days longer, cod liver oil was added to the rations of 7 of the animals in such proportions that in one diet 2 per cent replaced 2 per cent of dextrin and in the other 1 per cent replaced 1 per cent of maize. The modified diet was fed to 4 animals selected from the first group for 2, 4, 7, and 8 days, respectively, and to 3 from the second group for 3, 5, and 7 days, while the original diet was continued for the other animals until the end of the cod liver oil treatment, when all were killed and the bones examined for gross and microscopic histological changes.

In all of the control animals not receiving cod liver oil the cartilages and metaphyses of the bones were found to be completely freed from lime salt deposits, while in all but one of the animals receiving cod liver oil calcification of the matrix of the proliferative zones of cartilages had taken place.

"The results of this series of preliminary experiments are twofold. They afford ocular and conclusive evidence of the specific beneficial effect of cod liver oil on rats suffering with experimental rachitis, in that some substance or substances in the oil cause calcium to be deposited in the same fashion in which deposition occurs in spontaneous healing of rachitis in man. Moreover, they prepare the way for the elaboration of a new test, which it is to be hoped may eventually prove even to be roughly quantitative, for the deter-

mination of the calcium-depositing potentiality of any substance in terms of cod liver oil units. It is especially interesting to note in the present experiments that calcium was deposited in the cartilages following the initiation of the cod liver oil treatment, in spite of the fact that in some cases the calcium intake was far below normal. In view of the fact that in human cases of rickets the blood calcium is maintained throughout the disease at approximately the normal level it is interesting to speculate concerning the source from which the calcium deposited in the proliferative cartilage is derived."

Studies on Bacillus botulinus.—I, Destruction of botulinus toxin by heat, P. F. ORR (*Jour. Med. Research, 42 (1920–21), No. 2, pp. 127–136, figs. 7*).—The resistance to heat of the toxins produced by different strains of *B. botulinus* was tested by heating the toxins prepared under standard conditions in small test tubes in DeKhotinsky electrically heated and regulated oil baths and at regular intervals withdrawing 0.5 cc. portions of the toxin and injecting them intraperitoneally into white mice weighing 20 gm.

All of the toxins tested were found to be comparatively thermolabile. At 80° C. they were destroyed within from 30 seconds to 5 minutes, at 72° within from 2 to 18 minutes, and at 65° within from 10 to 85 minutes. The average temperature coefficient of the destruction of the toxins on increasing the temperature from 65 to 72° was found to be 5.2, while on increasing the temperature from 72 to 80° the average temperature coefficient was 4.2. The toxin produced by the Nevin strain was apparently more resistant to heat than any of the other toxins tested.

Botulism from cheese, M. NEVIN (*Jour. Infect. Diseases, 28 (1921), No. 3, pp. 226–231*).—This paper describes the cultural characteristics and toxin forming powers of the Nevin strain of *Bacillus botulinus*, originally isolated from homemade cottage cheese, which had caused the death of three people in New York in 1914. It is pointed out that "this appears to be the first time that *B. botulinus* has been isolated from cheese, that a soluble bacterial toxin has been detected in cheese, and that *B. botulinus* has been isolated in America."

An outbreak of botulism at St. Anthony's Hospital, Oakland, Calif., in October, 1920, J. C. GEIGER (*Pub. Health Rpts. [U. S.], 35 (1920), No. 48, pp. 2858–2860*).—In this outbreak of botulism, traceable to canned spinach, one of the cases obtained late and treated with botulinus serum A and B recovered, evidently as the result of serum treatment.

ANIMAL PRODUCTION.

Research in animal breeding, I–IV, R. C. PUNNETT (*Jour. Min. Agr. [London], 28 (1921), Nos. 1, pp. 11–17, pl. 1, fig. 1; 2, pp. 110–116, pl. 1, figs. 2; 3, pp. 252–259, pls. 2, figs. 2; 4, pp. 326–334, pl. 1, fig. 1*).—These articles are nontechnical presentations of the elements of animal genetics, the illustrative material being taken mainly from the investigations conducted by the author and his associates. In the first two articles color and horns in cattle are used as simple examples of Mendelism. In the third paper the work on inheritance of weight in poultry (E. S. R., 32, p. 572) and rabbits (E. S. R., 42, p. 763) is cited as illustrating the multiple factor hypothesis, while the fourth paper is mainly an account of sex-linked inheritance.

Leonard Doncaster, 1877–1920, W. B[ATESON] (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 646, pp. XLI–XLVI, pl. 1*).—This obituary includes a brief survey of Doncaster's contributions to animal genetics and cytology.

Racial investigations.—IV, The genetic behavior of a secondary sexual character, J. SCHMIDT (*Compt. Rend. Lab. Carlsberg, 14 (1920), No. 8, pp. 12, pls. 5, fig. 1*).—The author reports some breeding experiments with an aquarium fish, *Lebistes reticulatus*. A race in which a black spot occurs on the dorsal fin in the male was crossed with a second race in which such spots do not appear. Females never show the spot. It was found that males without the spot produced unspotted offspring exclusively without regard to the race of the mother, whereas all the male offspring of spotted males were similarly spotted. The author points out that the spotted character is distributed exactly like the Y chromosome, and suggests that it is borne on this chromosome. The case appears to be the first in which heredity factors could be assigned to the Y chromosome on the basis of definite experimental work.

A new type of inheritance, W. E. CASTLE (*Science, n. ser., 53 (1921), No. 1371, pp. 339–342*).—The author calls attention to the importance of the paper by Schmidt noted above and speculates on the evolution of the X and Y chromosomes. The type of sex-linked inheritance found in poultry is explained on the assumption that the oögonium contains X and Y and the spermatogonium 2 Ys.

Studies on crossing over.—I, The effect of selection on crossover values, J. A. DETLEFSEN and E. ROBERTS (*Jour. Expt. Zool., 32 (1921), No. 2, pp. 333–354, figs. 2*).—In two series of experiments at the Illinois Experiment Station, it was found possible to reduce the percentage of crossing over between white eye and miniature wing (genes on the sex chromosome) in the female *Drosophila melanogaster* in one case to 0.6 and in the other to 5 or 6. The normal value is about 33. After a number of generations the stocks continued to maintain these lower percentages without further selection. Attempts to select for high crossing over values were not successful, due it is thought to an increased number of double crossovers. The authors do not believe that crossover percentages can be used validly as measures of the distance between genes.

Further studies on the effect of temperature on crossing over, H. H. PLOUGH (*Jour. Expt. Zool., 32 (1921), No. 2, pp. 187–202, figs. 3*).—In an earlier paper[4] the author showed that exposure of female *Drosophila melanogaster* in the late larval stage to high or low temperatures induces a high proportion of crossing over between the genes associated with the second chromosome. The results reported in the present paper show that high temperatures are without effect upon the genes of the first (sex) chromosome, but produce a marked increase in crossing over in the middle region of the third chromosome. The effects of temperature are thought to be similar to the known effects of age on crossing over. Since the chromosomal regions which are "sensitive" to environmental changes also show a high ratio of double to single crossing over, it is suggested that the effects of the environment are most noticeable where crossing over is least free.

Genetical investigations in the crossing of guinea pigs, I, A. PICTET and FERRERO (*Soc. Phys. et Hist. Nat. Genève, Compt. Rend., 38 (1921), No. 1, pp. 32–37*).—In experimental crosses between ordinary short-haired colored guinea pigs and white angora guinea pigs, the authors found that the F_1 were short haired and pigmented, but the hair formed two whorls or rosettes instead of being smoothly distributed over the body. There were 18 types recognized in the 124 F_2 individuals, the large number of types being due to varying expression of the rosette character. The ratios are close to expectation on the assumption of three dominant factors, color, rosette, and short hair. No white angoras appeared in the F_2, but this type was abundant in back crosses.

[4] Jour. Expt. Zool., 24 (1917), No. 2, pp. 147–209.

Dictyokinesis in germ cells, or the distribution of the Golgi apparatus during cell division, R. J. Ludford and J. B. Gatenby (*Proc. Roy. Soc. [London], Ser. B, 92 (1921), No. B 646, pp. 235–244, pls. 2*).—Using the silver nitrate and osmic acid techniques, the author has studied the behavior of the Golgi apparatus during cell division in the testes of rats, guinea pigs, an insect, and several mollusks. Although the Golgi apparatus is an integral part of the cell, it was found that its distribution between daughter cells takes place by a haphazard process of sorting out individual pieces formed by the disintegration of the apparatus during the prophase of mitosis. There was no division of the individual elements, and it is concluded that the Golgi apparatus can have no important part in the hereditary processes.

The heterochromosome problem in vertebrates.—I, Investigation of the early oögenesis of the domestic cat, S. Gutherz (*Arch. Mikros. Anat., 94 (1920) pp. 338–364, pls. 2*).—The heterochromosome-like structure observed in oöcytes of the cat by Winiwarter and Sainmont was found not to be a chromosome, but a nucleolus. Its peculiar size and appearance is due to methods of fixation.

Mitoses in the seminal epithelium of the cat, H. de Winiwarter (*Arch. Biol., 30 (1919), No. 1, pp. 1–87, pls. 2*).—In the testes of the cat the author finds 34 autosomes and one heterochromosome during the last spermatogonial division. The heterochromosome, which is elongated and often curved, does not divide in the first spermatocyte (reduction) division. It is not visible in resting spermatogonia and is easily distinguishable from the nucleolus, which is spherical and visible in the spermatogonia. The "monosome" described by various authors in the germ cells of the female is thought to consist of the two heterochromosomes in close proximity.

Observations on the interstitial cells are included.

A study of testis and ovary grafts on the hen's egg and their effects on the embryo, T. Minoura (*Jour. Expt. Zool., 33 (1921), No. 1, pp. 1–41, pls. 10, fig. 1*).—In the author's experiments, pieces of testis or ovary from chickens of various ages were grafted on the chorio-allantoic membrane of developing chick embryos. In a number of cases the implant grew and established vascular connections with the allantoic blood vessels. The following intersexual characters were exhibited in varying degrees by these embryos: (1) The simultaneous existence of gonads of the male type and differentiated Müllerian ducts of the female type; (2) gonads of the male type with the one on the left side enlarged as in a normal female; and (3) persistence of the right gonad in female-type embryos. Grafts of other organs (liver, spleen, thyroid, and thymus) did not produce such conditions.

"Consideration of the experimental data leads us to the following conclusion: The testis and ovary of the chick secrete certain physiological substances, which we may designate sex hormones. When these secretions are introduced into the body of an embryo they exercise a specific effect upon its reproductive system. The development and differentiation of one sex is stimulated by the secretion of the gonad of the same sex and inhibited by the secretion of the gonad of the opposite sex. By means of these secretions the differentiation of sex in the chick can be controlled to some extent. It may furthermore be stated that the two sexes bear a quantitative and not a qualitative relation to each other."

Structures and homologies of freemartin gonads, B. H. Willier (*Jour. Expt. Zool., 33 (1921), No. 1, pp. 63–127, figs. 18*).—The author has made an anatomical study of the gonads of 7 fetal freemartins studied by Chapin (E. S. R., 40, p. 466) and 9 freemartins slaughtered after birth at ages ranging

from 5 days to 3 years. Six of the latter were furnished by L. J. Cole from the collections of the Wisconsin Experiment Station.

The author accepts Lillie's theory that the freemartin is primarily a female transformed in a male direction under the influence of hormones from the male twin, and recognizes three distinct stages in this transformation. All structures and tissues in the gonads were found to be affected. The sex cords exhibit a series of gradations between medullary cords and seminiferous tubules, the latter complete except for the absence of germ cells. The rete ovarii is transformed into a rete testis by the development of connections between the rete tubules and the seminiferous and epididymal tubules. The epididymis is absent from gonads exhibiting a low degree of transformation; the head alone is present when there is a moderate degree of transformation, while a typical epididymis is present in the highly transformed sex gland. The existence of a graded series is attributed to variability in (1) the time of introduction of the male hormones, (2) potency of the hormones, and (3) the duration of the hormonic action.

The freemartin and its reciprocal, C. G. HARTMAN (*Science, n. ser., 52 (1920), No. 1350, pp. 469–471*).—The author describes an adult sex-intergrade opossum. The external genitalia were those of a male, while internally there were infantile vaginal canals, uteri, and Fallopian tubes. The gonads were situated in the position of the ovaries and consisted of closely packed tubules of uniform size without trace of germ cells.

Nothing is known of the history of this specimen, but it is interpreted as a male that, during the brief gestation period (10 days), developed female characters through the fusion of its chorionic blood vessels with those of a female co-twin. The term reciprocal freemartin is proposed for such a sex-intergrade, and the explanation adopted is frankly based on Lillie's hormone theory (E. S. R., 40, p. 466). Steinach's assumption (E. S. R., 28, p. 173) of antagonistic sex tendencies originating from the presence of both male and female interstitial cells in the embryonic gonad is considered superfluous as an explanation of the freemartin and the reciprocal freemartin types of pseudo-hermaphroditism.

Sexless twins.—A common form of hermaphroditism in cattle, H. MAGNUSSON (*Arch. Anat. u. Physiol., Anat. Abt., 1918, No. 1, pp. 29–62, figs. 8*).—The author reports anatomical studies of 66 freemartins, usually 2 to 3 years of age, of which 11 are described in detail. The material was secured from slaughterhouses at Malmo, Sweden.

Externally some of the animals were fairly typical females, but practically all showed some male characters in the internal organs, although in only 4 cases were the gonads in or close to the scrotum. Typical seminiferous tubules and interstitial cells occurred in these gonads, but no spermatogenesis. In the remaining cases the gonads were in the position of the ovaries and seemed to be ovotestes. In 37 cases the uterus was well developed and the ductus deferentia were rudimentary.

Four sets of uterine twins were also examined. In two cases the twins were both females, and in one of these the chorions were fused. One pair consisted of a normal male and a normal female, but the chorions were separate and there was no vascular anastomosis. In the remaining case the chorions had vascular connections; one twin was a male with well developed sex organs and the other a "male" with rudimentary organs. Two corpora lutea were found with each pair of uterine twins. The author questions the importance of the fused vascular system discovered by Tandler and Keller (E. S. R., 41, p. 672), and is inclined to adopt the "Mendelian" explanation of freemartins proposed by Hart (E. S. R., 25, p. 474; 33, p. 668).

The internal secretions in growth and development of amphibians, E. UHLENHUTH (*Amer. Nat., 55 (1921), No. 638, pp. 193–221*).—The author reviews the great advances in the knowledge of the functions of the thyroid gland and the hypophysis (pituitary) which have been made in recent years as the result of experiments with amphibians. For such studies amphibians possess manifold advantages over the higher vertebrates, since the early stages are under the control of the investigator. There is a bibliography of about 60 titles.

The bearing of recent research on problems of nutrition, D. G. O'BRIEN (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 140–148*).—The author discusses the importance of vitamins in animal feeding, and reports briefly a feeding experiment at the West of Scotland Agricultural College in which 48 pigs were fed for 19 weeks on a ration of corn, bran, and middlings, supplemented by whey. An increase in the whey consumption toward the end of the experiment caused an improvement in the rate of growth, but no such improvement was made when the whey was temporarily increased at an early stage, although an increase in the amount of grain at this stage increased the growth. Since the pigs had been on a milk diet prior to the experiment, it is thought that they had an ample reserve of vitamin A and thus derived no benefit from the added vitamins provided by the whey. Later, when the reserve was depleted, growth was promoted by the feeding of more vitamins.

Fodder values, I, II, D. W. STEUART (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 155–164*).—Continuing the paper noted on p. 379, the author applies the feed unit concept to the feeding of pigs and horses, using the tables and discussions in Hansson's manuals. Some of the experiments leading to the formulation of the tables have been noted (E. S. R., 33, p. 471; 34, p. 468; 35, p. 773; 36, p. 370).

The dietetic value of cereals and their products, W. J. COLEBATCH (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 7, pp. 613–617, 619–623, 625–628*).—This is a discussion of the use of oat, barley, wheat, and rye plants in animal feeding, and includes proximate analyses of (1) the freshly cut plant including two stages of oats and barley, (2) the hay including three stages of wheat, (3) the straw including oat straw cut at three stages, (4) the chaff, and (5) the whole grains and also wheat bran, wheat shorts, brewers' dried grains, and malt coombs. It is stated that cereal silage is being used by sheep farmers in Australia during the autumn rains. Wheat of the macaroni type with semisolid stems in combination with oats is recommended for this purpose.

The composition and digestibility of Sudan grass hay, darso, darso silage, broom corn seed, and sunflower silage, C. T. DOWELL and W. G. FRIEDEMANN (*Oklahoma Sta. Bul. 132 (1920), pp. 3–8*).—The authors report analyses of feeds and digestion trials with sheep. Collection periods lasted 5 days, and usually a wether, a ram, and a ewe were used in each experiment. The following table summarizes the results:

Composition and digestibility of Oklahoma feeding stuffs.

Feeds.	Composition.						Digestibility (sheep).				
	Water.	Protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Dry matter.	Protein.	Ether extract.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Darso	11.72	11.76	3.30	3.82	67.47	1.93	72.8	56.5	68.9	(1)	84.1
Broom-corn seed	10.06	13.37	3.64	9.04	59.62	4.27	60.3	33.9	91.9	(2)	69.2
Sudan grass hay	7.92	8.45	1.29	32.45	43.66	6.23	56.1	46.9	57.1	58.8	60.8
Sunflower silage	71.96	2.96	.81	8.67	12.36	3.23	63.7	(2)	65.4	72.5	73.1
Darso silage	73.11	1.91	.34	6.46	16.65	1.54	56.1	[3] 10.3	59.8	(2)	70.4

[1] Negative. [2] Wide range. [3] Average of two determinations; third negative.

The darso and broom corn were fed in conjunction with Sudan grass hay. During the feeding of sunflower silage relatively small amounts were consumed, and defecation was irregular.

The composition and feeding value of silage (*Jour. Min. Agr. [London], 27 (1920), No. 3, pp. 277–281*).—Proximate analyses by G. Williams are reported of single-crop silages made from clover, corn, grass, and Trifolium, and the following types of mixed silage: (1) Grass, tares, and oats; (2) tares and oats; (3) tares, wheat, and oats; (4) tares, oats, rye, and marsh grass; (5) tares, oats, rye, beans, and wheat; and (6) rye, oats, and tares.

A cheap and convenient experimental silo, H. L. Westover and S. Garver (*Jour. Amer. Soc. Agron., 12 (1920), No. 2, pp. 69–72*).—This contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, consists of a brief review of early studies at the State experiment stations on experimental silos, followed by the report of preliminary experiments at the Department field station at Redfield, S. Dak., on the use of motor oil barrels as silage containers.

The materials, consisting of alfalfa, sweet clover, corn, sorghum, Sudan grass, Russian thistle, wild sunflowers, soy beans, corn and alfalfa 1:3, sorghum and alfalfa 1:1, and corn and alfalfa 1:1, were cut in a hand-feed cutter into ⅞-in. lengths and packed tightly into the barrels by trampling and by heaping so that the cover had to be forced in. To further exclude the air the barrel heads were covered with a thick coat of paint. The contents of the barrels weighed from 150 to 200 lbs., depending upon the material and the tightness of packing.

After standing about 3 months the barrels were opened and the contents fed to cattle unaccustomed to silage. All of the materials were eaten readily with the exception of the Russian thistle, which was refused absolutely, and of the wild sunflower, which was eaten very sparingly by one cow. It was thought that the wild sunflower had not fermented properly, probably owing to the presence of resinous substances. The authors conclude that the method may be used advantageously in testing the value of different plants for silage.

The quality of silage produced in barrels, R. Newton (*Jour. Amer. Soc. Agron., 13 (1921), No. 1, pp. 1–11*).—A more elaborate study than the one noted above of the suitability of barrels as containers for experimental silage is reported. The silage materials used were Northwestern Dent corn in the early milk stage of maturity, Mammoth Russian sunflowers with seeds just beginning to develop, corn and sunflowers 1:1, Banner oats in the dough stage, and Silverhull buckwheat with well-developed seeds. All of these crops were frozen September 1, and were cut September 3 and 5. The barrels were filled in the field with the materials cut in ½-in. lengths and firmly packed, each barrel holding about 250 lbs. of the material. The barrels were closed with loose-fitting covers and stored in the basement of the experimental barn until early in the following June. When the barrels were opened for examination, the blackened portion from the top and additional material showing decay were removed and the remainder divided into two portions representing second and first quality silage. Samples of both were analyzed for moisture content, total, nonvolatile, and volatile acidity, and total and amino nitrogen. The analyses reported as compared with samples taken from an ordinary farm silo and published results of silage analyses indicated that the barrel silage was normal in all important respects.

Palatability tests were conducted by feeding to a dairy herd of 10 cows from 8 to 10 lbs. each of the experimental silage in addition to the regular evening feeding of from 15 to 20 lbs. of pea-and-oat silage. The order of increasing palatability, as judged by these tests, was sunflower which was not

entirely eaten, buckwheat which was left to be eaten last, corn and sunflower, peas and oats, and oats alone, the last being eaten with avidity before the regular feed.

Report on commercial feeding stuffs, 1920, E. M. Bailey (*Connecticut State Sta. Bul. 229 (1921), pp. 293–323*).—The proximate composition and retail prices are reported of cottonseed meal, cottonseed feed, linseed meal, wheat bran, wheat mixed feed, wheat middlings, rye middlings, corn gluten feed, corn meal, hominy feed, distillers' dried grains, dried beet pulp, peanut oil meal, coconut oil meal, carob beans (including pods), and various proprietary stock feeds, calf meals, and poultry feeds.

Commercial feeding stuffs, A. McGill (*Jour. Assoc. Off. Agr. Chem., 4 (1921), No. 3, pp. 351–360*).—This article deals with Canadian usage in the definition of feeding stuffs, mainly wheat by-products. Little difference has been found in the composition of materials sold as shorts and as middlings, and in many cases because of the low fiber content they conform to the definition of feed flour. It is held that elevator screenings should not be allowed to enter commerce without being inspected for poisonous weed seeds.

Purebred sires lead rapidly to improvement in female stock, D. S. Burch (*Jour. Heredity, 12 (1921), No. 1, pp. 45–48, figs. 3*).—This is a report of the progress of the "better sires—better stock" campaign of the Bureau of Animal Industry, U. S. Department of Agriculture (E. S. R., 42, p. 866). The article is illustrated with halftones of bas-reliefs of early Egyptian cattle and Assyrian horses which indicate that the ancients had live stock that approached modern ideals in conformation.

Scottish purebred live stock, III–VII (*Scot. Jour. Agr., 3 (1920), Nos. 2, pp. 165–174, pls. 4; 3, pp. 295–302, pls. 2; 4, pp. 438–443, pls. 2; 4 (1921), Nos. 1, pp. 31–48, pls. 4; 2, pp. 148–155, pls. 2*).—These five papers continue the two previously noted (E. S. R., 43, p. 171) and deal with the history and characteristics of various Scottish breeds. The titles of the respective papers and their authors are as follows: Galloway Cattle, by F. N. M. Gourlay; Highland Cattle, by J. Cameron; Ayrshire Cattle, by J. Howie; The Clydesdale Horse, by A. MacNeilage; and Highland Ponies, by R. Inglis and J. M. Mackenzie.

Genetics of Hereford cattle, W. E. Castle and W. L. Wachter (*Jour. Heredity, 12 (1921), No. 1, pp. 36–39, figs. 2*).—The authors review the work of Pitt (E. S. R., 43, p. 375) and criticize some of her conclusions on the grounds of undue simplification, particularly in the treatment of muzzle pigmentation and body color. They lament the fact that the frequencies of the different grades of white spotting were not published, and suggest that the factors for excess white and for dark neck may on further analysis prove to be dominant and recessive members, respectively, of the same set of allelomorphs.

Better cattle in the range country, R. R. Hill (*Breeder's Gaz., 79 (1921), No. 2, pp. 59, 60, figs. 2*).—An account of cooperative demonstration work undertaken by the Forest Service of the U. S. Department of Agriculture at the Santa Rita Range Reserve for the purpose of developing a type of range cattle suitable for Arizona conditions.

Cattle feeding investigations, W. L. Blizzard (*Oklahoma Sta. Bul. 134 (1920), pp. 3–7, figs. 3*).—To compare sunflower silage and darso silage for fattening baby beef, 2 lots of seven 425-lb. grade Hereford steers were fed for 150 days, beginning January 16, 1920, on a ration of 11 lbs. of corn, 1.07 lbs. of cottonseed meal, 13 lbs. of silage and 2 lbs. of alfalfa hay. The lot fed sunflower silage made a daily gain of 2.24 lbs. per head and the lot fed darso silage gained 2.29 lbs. Analyses of the two kinds of silage given in Bulletin 132 are repeated.

Some studies in cattle feeding, M. M. DESAI (*Poona Agr. Col. Mag., 11 (1919–20), No. 2–3, pp. 77–84*).—The author describes a certain amount of success in feeding durra straw and dried cotton stalks to cattle in Guzerat during a pasture shortage, and reports proximate analyses of these materials and also a number of native grasses (*Andropogon annulatus, Polytoca barbata, Eragrostis cynosuroides, Ophiurus cerymbosus,* and *Iseilema* spp.).

The durra stubble was chaffed and mixed with gul and linseed meal. The cotton stalks, which had been heaped in bundles, had the following percentage composition: Moisture 2.5, protein 11.75, ether extract 6.55, crude fiber 17.15, nitrogen-free extract 49.7, and ash 12.35. Owing to the high tannin content (9.14 per cent) only limited amounts were fed, but the animals voluntarily sought out the bundles in the field.

Sheep feeding investigations.—Comparative rations for fattening wether lambs, W. T. MAGEE and A. E. DARLOW (*Oklahoma Sta. Bul. 133 (1920), pp. 4, fig. 1*).—This is a report of a 96-day lamb-feeding trial begun November 20. The methods of feeding and the results are summarized in the following table:

Results of a 96-day lamb feeding trial.

Lot.	Concentrates fed and daily ration.	Number of lambs.	Initial weight per head.	Daily gain per head.	Consumed per pound of gain.				
					Cottonseed meal.	Kafir products.	Sudan hay.	Alfalfa hay.	Darso silage.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal (0.375 lb.)	21	60.9	0.199	1.88	(1)	9.29	.....	11.51
2	Cottonseed meal (0.55 lb.)	22	58.2	.213	2.58	(1)	8.32	.....	9.76
3	Kafir heads (0.84 lb.)	22	55.9	.303	.....	2.76	.....	6.38	7.21
4	Shelled kafir (0.79 lb.)	22	56.3	.333	.....	2.37	.....	5.88	6.53
5	Ground kafir (0.91 lb.)	21	58.2	.334	.....	3.00	.....	9.98	.....

[1] Kafir heads fed in limited amounts last 18 days.

Lot 2 went off feed after 70 days, but no losses occurred as a result of the heavy cottonseed meal ration. Lot 1 fed well to the end. Kafir in the head is considered too bulky a feed for lambs. Darso silage, being cheap, increased the profits of lots 3 and 4 in comparison with lot 5.

Methods of feeding sheep during periods of temporary shortage of grazing, W. J. SPAFFORD and E. A. BRISTOW (*Jour. Dept. Agr., So. Aust., 24 (1921), No. 6, pp. 491–493, 495–498, figs. 2*).—The authors report observations on methods of hand-feeding sheep with chaff and grain for short periods, and conclude that a bag trough is less wasteful than a V-shaped wooden trough. The bag trough consists of old superphosphate bags supported on a framework of lumber and fencing wire.

Accounts of a Hampshire Down flock, A. D. HALL (*Jour. Min. Agr. [London], 28 (1921), No. 2, pp. 104–109*).—In this paper are summarized the cost accounts of a purebred Hampshire Down flock for the year ended September 29, 1920, in continuation of the 1918–19 accounts previously noted (E. S. R., 43, p. 570).

The figures again illustrate the unprofitableness of pedigree ram breeding in England when home-grown feeds are charged at farm prices. Part of the high cost is due to the necessity of crowding lambs for the August shows.

Weight of fleece as related to length of wool, V. O. MCWHORTER (*Natl. Wool Grower, 11 (1921), No. 3, p. 14*).—In this paper and the two whose titles follow, the author presents and discusses briefly some data collected in the course of the sheep breeding experiments of the U. S. Department of Agricul-

ture. The material is the same as that reported by Marshall (E. S. R., 44, p. 868) with the addition of the 1920 figures.

Length of staple as related to fineness of fleece, V. O. McWhorter (*Natl. Wool Grower, 11 (1921), No. 4, pp. 15, 16*).

Fleece and body weights as related to face covering, V. O. McWhorter (*Natl. Wool Grower, 11 (1921), No. 5, p. 9*).

Some feeding tests with pigs, A. J. Perkins (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 471, 473–475*).—This paper reports a six-week experiment showing increased gains when barley was supplemented by pig meals made of animal waste products put on the South Australian market by the Metropolitan Abattoirs Board. The results are also cited in favor of the author's contention that barley is best marketed through live stock.

Some feeding experiments with dried blood, L. F. Newman (*Jour. Min. Agr. [London], 27 (1920), No. 3, pp. 266–271*).—Four lots of seven 55-lb. pigs were used in this experiment. The lot fed corn meal alone lost 3 lbs. in 11 weeks, while the lot fed corn meal and dried blood made a total gain of 208 lbs. The feeding of wheat offals alone and wheat offals plus dried blood resulted in total gains per lot of 218 and 284 lbs., respectively. The dried blood consumed averaged about 4 oz. per head per day. At the close of the experiment some of the pigs in each lot were continued for four weeks on the experimental ration, half of the pigs receiving a kohl-rabi plant per day in addition. The green feed increased the gains except in the case of the wheat-blood ration.

An experiment with fattening pigs to compare cooked potatoes with raw potatoes (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 190–193*).—In five experiments in different parts of Ireland in which pigs were fed potatoes and various grain mixtures, it was found that the fattening period was curtailed when the potatoes were cooked.

Pig feeding and the cost of pork production, A. G. Ruston (*Jour. Min. Agr. [London], 27 (1920), No. 4, pp. 340–349, fig. 1*).—The author deplores the decline in pig raising in England and the resulting increase in the import of pork products, and summarizes the accounts of a Yorkshire farm to show that pork production was profitable even in 1918–19, when feeds were abnormally expensive.

Genetics in the crossing of poultry, R. Chodat (*Soc. Phys. et Hist. Nat. Genève, Compt. Rend., 38 (1921), No. 1, pp. 17–21*).—The F_1 of the cross Black Minorca ♂ × White Orpington ♀ resembled the Orpington in body form. The plumage was much like that of the wild jungle fowl, but with an excess of black. Of the F_2 cocks one was pure white, two showed the cuckoo pattern, and four were colored more or less like the F_1 cocks. Of the F_2 pullets one was black and four were white. One white pullet laid white eggs like the Minorca; the other pullets, including the black, laid brown eggs. The author appears to have had no difficulty in classifying the F_2 individuals into Minorca and Orpington types. There was also clear segregation in the color of the tarsus.

Lamona—a new breed of poultry, H. M. Lamon (*Jour. Heredity, 12 (1921), No. 1, pp. 2–29, figs. 27*).—This is a report of the successful issue of an attempt, begun in 1912 by the Bureau of Animal Industry, U. S. Department of Agriculture, to develop a general purpose breed laying white-shelled eggs, by crossing established breeds possessing characters it was desired to combine.

In the first season a White Plymouth Rock cockerel was mated to a Silver Gray Dorking hen, and in the second season Single Comb White Leghorn cockerels were mated to the crossbred pullets and also to Silver Gray Dorkings. Selected offspring of these matings were used for subsequent breeding without further crosses with standard-bred fowls. The breed as finally formed is

characterized by long deep bodies, white-shelled eggs, white feathers, yellow legs, four toes, medium-sized combs and wattles, and red ear lobes. The last-named character was secured with considerable difficulty, but was desired as a distinguishing mark to differentiate the breed from the larger type of Leghorn. Various color markings appeared in the course of the experiment, particularly different types of barring, and a pen showing the pyle pattern is being bred.

A footnote by G. M. Rommel states that the Secretary of Agriculture has directed that the breed be named after its originator.

Culling, a practical plan to eliminate the nonproducing hen, W. H. Allen (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 9, pp. 4, fig. 1*).—This is an outline of the physical characteristics which are supposed to indicate whether a hen is laying or not in the summer.

Milk a panacea for poultry ills, H. R. Lewis (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 8, pp. 4, fig. 1*).—A general statement of the desirability of including milk products in the rations for growing chicks.

Poultry keeping in fruit plantations, G. H. Garrad (*Jour. Min. Agr. [London], 27 (1920), No 4, pp. 350–359*).—The accounts of a 20-acre combined apple, plum, and poultry farm in Kent for five years are presented to show that poultry raising is a profitable adjunct to fruit growing for the small holder.

The importance of the poultry industry to Ireland, L. Murphy (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 208–216, pls. 2*).—Data are presented showing the exports of poultry, eggs, and feathers from Ireland in 1908, 1909, 1918, and 1919, with particular reference to the export of eggs to Great Britain. Comparable data for other countries and other Irish agricultural products are also included. Increase in winter egg production by improved breeding and feeding methods is considered essential if the export trade in eggs is to be maintained under post-war competition.

A treatise on silver fox farming, F. F. Tuplin (*Alpine, Mich.: Author, 1921, pp. [32], figs. 10*).—This pamphlet on the feeding and management of silver foxes in captivity is based upon extensive experience of the author in Prince Edward Island and in Michigan.

Aids to successful oyster culture.—I, Procuring the seed, T. C. Nelson (*New Jersey Stas. Bul. 351 (1921), pp. 59, figs. 26*).—This is the first bulletin of a series presenting in condensed form the results of the oyster culture investigations begun in 1888 by the late Julius Nelson and continued since 1916 by the author. A sketch is given of the reproduction of the oyster and the development of the larva, and there is a detailed account of the influence of tides, currents, wind, wave action, salinity, and other factors on the abundance and distribution of the larvae, with notes on the destructive agencies and the depletion of the natural beds. The microscopic examination of the water to determine the distribution of the larvae is considered of prime importance in seed production, so that the cultch can be put down only at spawning places and not scattered broadcast over the bottom. As an aid in this process, directions are given for the collection and examination of water samples.

DAIRY FARMING—DAIRYING.

The rate of growth of the dairy cow.—Extrauterine growth in weight, S. Brody and A. C. Ragsdale (*Jour. Gen. Physiol., 3 (1921), No. 5, pp. 623–633, figs. 3*).—By plotting the monthly average gains against age, the authors found evidence of two postnatal cycles in the growth of Holstein and Jersey heifers at the Missouri Experiment Station. Inspection of the graphs showed that the maximum growth velocity in the first cycle occurred at about the age of 4.5

months in the Holsteins and at about 5 months in the Jerseys. The second cycle in both cases had a rather ill-defined maximum at 20 months.

According to T. B. Robertson the rate of gain in each cycle should follow the equation of an autocatalytic reaction. By means of simple graphical methods and Robertson's tables [5] the authors have fitted such equations to their data. For the first Holstein cycle (9 months) they derived the formula

$$\log \frac{x}{550-x} = 0.158\ (t-4.5)$$

where t is the age in months and x is the weight in pounds at age t. The equation for the first Jersey cycle (10 months) is

$$\log \frac{x}{444-x} = 0.169\ (t-5).$$

In these equations the slight gain during the uterine growth cycle is ignored.

A similar equation was fitted to the data on the second Jersey cycle, but owing to the disturbing influence of pregnancy and lactation on growth, the authors do not attach much significance to the results.

Calf feeding experiment (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 201–204*).—In view of the success with oats in previous calf feeding tests (E. S. R., 41, p. 873) more elaborate experiments were conducted in 21 centers during 1918 and 1919. The 70 calves fed skim milk (with a little whole milk and some buttermilk) and whole oats made a daily gain of 1.32 lbs. per head during an average feeding period of 122 days. The 70 calves fed similarly, but with the oats crushed, gained 1.34 lbs. In one center whole oats caused digestive disturbances, and in another there was difficulty in getting calves to eat the whole oats.

Fodder values for milk recording societies, and dairy herds, D. W. Steuart (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 433–438*).—This is an exposition of the methods of using the Scandinavian feed units (barley equivalents). These are considered better suited to dairy cattle than Kellner's starch values, since the latter were based upon fattening experiments. The data are taken from the manuals of Hansson, whose paper on the extension of the feed unit system to dairy cattle has been noted (E. S. R., 31, p. 371).

Milk recording in Scotland, W. Stevenson (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 379–391*).—This is an account of the development of official milk tests in Scotland since 1903, with a description of the procedure now used by the Scottish Milk Records Association which was formally organized in February, 1914. Each local society has its resident recorder, approved by the association, who makes one-day visits in rotation to each farm in his circuit. There are provisions for unannounced inspections and "surprise check tests."

"Experience has confirmed the view that a very useful comparison is obtained by reckoning the yields at their estimated equivalent of milk of 1 per cent of milk fat. Such a comparison takes into consideration both the quantity and the quality of the milk. Cows with a milk record equivalent to not less than 2,500 gal. at 1 per cent of fat and heifers with a milk record equivalent to not less than 2,000 gal. at 1 per cent of fat are grouped into Class I. Cows and heifers with milk records of less than two-thirds of these amounts, namely, 1,660 and 1,330 gal., respectively, are grouped into Class III. All cows and heifers with milk yields between these limits fall into Class II."

Publication of the records of all Class I animals, with full particulars of ownership, was started in 1917. In the early days of milk testing owners objected to the publication of records, even of their good cows, but now the value of these records in increasing the prices of cattle is clearly recognized.

[5] Calif. Univ. Pubs. Physiol., 4 (1915), No. 21, pp. 211–228.

New world record fat producer, F. E. Ellis (*Hoard's Dairyman, 61 (1921), No. 24, p. 935 fig. 1*).—The author reports that the Holstein cow, Bella Pontiac, owned in Ontario, gave 27,017 lbs. of milk and 1,258.4 lbs. of fat in a year's Advanced Registry test completed in June, 1921, thus exceeding the record for fat production hitherto held by Duchess Skylark Ormsby (E. S. R., 34, p. 472).

Dairy farming on arable land (*Liverpool: R. Silcock & Sons, Ltd., pp. 144, figs. 5*).—This volume consists of five essays written, respectively, by J. C. Brown, J. Skinner, H. G. Robinson, W. Petre, and C. L. Coxon, offered in competition for prizes donated by the publishers. The essayists concern themselves particularly with suggestions for soiling systems for dairy cows, but many other aspects of dairy farming in Great Britain are considered.

The milk supply of the city of Edinburgh, A. Cunningham and B. A. Thorpe (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 429–433*).—The bacterial content of 40 samples of market milk collected in Edinburgh in the autumn of 1919 varied from 20,000 to 29,000,000 per cubic centimeter. About half of the samples contained lactose-fermenting organisms in high numbers. A table summarizes published milk counts in other cities throughout the world.

Clarification of milk, C. E. Marshall, E. G. Hood, et al. (*Jour. Dairy Sci., 3 (1920), No. 4, pp. 245–259, fig. 1*).—This is mainly a detailed account of the observations on the physical, chemical, and biological differences between clarified and unclarified milk reported in a preliminary paper (E. S. R., 44, p. 179). In addition to the points there noted, the authors emphasize the disturbances in the associative action of the organisms present that are brought about by the selective removal of the larger ones.

The effect of pasteurizing temperatures on the paratyphoid group, E. M. Twiss (*Jour. Infect. Diseases, 26 (1920), No. 2, pp. 165–170*).—In a series of experiments the author found that various strains of *Bacillus paratyphosus A*, *B. typhosus*, *B. enteritidis*, and *B. suipestifer* survived in milk pasteurized for 30 minutes at 60° C. and then cooled, while some strains of *B. paratyphosus B* survived similar exposure to 65°. The organisms were seldom recovered from plate cultures made immediately after pasteurization, but they were abundant in milk incubated at 37.5° for 24 hours after a period of cooling to simulate commercial practice. The negative results from plate cultures are attributed to the small size of the samples used.

It is thought that only certain very resistant organisms survived the high temperatures and that the greater number died out as the temperature approached 60°.

Sudden physiological mutations in the lactic acid bacteria through individual divergences, C. Gorini (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 22, pp. 1382–1384*).—In pure cultures of *Streptococcus lacticus* and other lactic acid bacteria, the author has found upon several occasions sudden spontaneous changes in the physiological characteristics, particularly in the proteolytic action in milk cultures. In some cases the cultures returned later to their original state. This phenomenon is explained by Richet's principle of individual divergence, and in the author's opinion indicates that a large number of the named species, subspecies, races, types, and varieties of lactic acid bacteria will have to be discarded.

Bacteriological investigations of the so-called yoghurt plants and kefir grains, J. Boersma (*Meded. Rijksseruminricht., 1 (1918), No. 7–8 pp. 344–373, figs. 10*).—The author reports that the growths known as yoghurt plants are true kefir grains, being formed by *Lactobacillus caucasicus B.* Yeast, though present, did not contribute to the structure, and the occurrence of other organisms is accidental. Much published work on the bacterial growths in fermented milks is reviewed.

On molded butter, F. W. J. Boekhout and J. J. O. de Vries (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 1–3, pp. 39–45, figs. 2*).—This is a report of a cultural and morphological study of a fungus, *Hormodendron cladosporioides* (*Cladosporium herbarum*), found growing in black-green colonies on the surface of storage butter in Friesland.

The mold seldom survived in butter containing more than 2 per cent salt, did not grow in the tub or on the paper, and had very little influence on the chemical composition of the butter. The temperature required to kill the spores in 10 minutes varied in different cultures from 43 to 48.5° C. The low thermal death point is thought to indicate that contamination occurred after pasteurization.

Commercial buttermilk, A. D. Burke (*Milk Dealer, 10 (1921), No. 8, p. 2*).—In experiments with culture buttermilk at the Oklahoma Experiment Station, it was found that wheying off usually occurred unless the acidity developed is between 0.6 and 0.7 per cent. The presence of gas-producing organisms in the starter also caused wheying off, but the viscosity of the culture seemed to be relatively unimportant.

Making American cheese on the farm, C. M. Gere (*U. S. Dept. Agr., Farmers' Bul. 1191 (1921), pp. 19, figs. 14*).—Detailed directions are given for the manufacture of Cheddar cheese on a small scale.

Methods of manufacturing ice cream, O. E. Williams (*Creamery and Milk Plant Mo., 10 (1921), No. 4, pp. 54, 56, 58, 74*).—An outline of methods for ice cream factories making up to 50 gal. per day.

VETERINARY MEDICINE.

Chemical pathology, H. G. Wells (*Philadelphia and London: W. B. Saunders Co., 1920, 4. ed., rev., pp. 695*).—In this fourth edition the subject matter of the preceding edition (E. S. R., 39, p. 79) has been thoroughly revised, particularly the section on reactions of immunity, the growing bulk of material on which has necessitated a rearrangement of material with a separate chapter on anaphylaxis and allergy. There has also been added a chapter on the chemistry of growth and repair, in which is included a brief discussion of vitamins and deficiency diseases.

The presence of microparticles in the blood and other body fluids, S. H. Gage and P. A. Fish (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 4, pp. 384–402, figs. 11*).—This is a report presented at the annual meeting of the American Veterinary Medical Association at Columbus, Ohio, in August, 1920.

Diseases, ticks, and their eradication, A. Theiler (*Union So. Africa, Dept. Agr. Jour., 2 (1921), No. 2, pp. 141–159*).—This is a popular summary of the status of knowledge of the subject.

Report of the New York State Veterinary College at Cornell University for the year 1919–20 (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 238, pls. 33*).—The following papers are included in this report: Some Notes Regarding the Selection and Shipping of Material for the Laboratory Diagnosis of Anthrax, Blackleg, and Septicemia Hemorrhagica, by W. A. Hagan (pp. 51–54); Researches upon the Diseases of Breeding Cattle, by W. L. Williams (pp. 55–66); Acute Indigestion in Ruminants, by D. H. Udall (pp. 67–76); Infectious Enteritis of Cats, by H. J. Milks and S. A. Goldberg (pp. 77–91); Coccidiosis in Cattle, by W. D. Way and W. A. Hagan (pp. 92–103); *Pseudomonas pyocyaneus* as a Factor in Pneumonia of Swine, by R. R. Birch and J. W. Benner (pp. 104–118); A Fatal Undiagnosed Disease of Cattle in the State of New York, by W. A. Hagan (pp. 119–127); The Diseases of the Oviduct of the Cow and Their Relation to Sterility, by H. L. Gilman (pp. 128–154); The Occur-

rence of Epithelial Tumors in the Domesticated Animals (pp. 155–169), and Epidermoid Carcinoma in Domesticated Animals (pp. 170–180), both by S. A. Goldberg; Studies on the Normal Blood of the Domesticated Animals.—I, Total Nonprotein Nitrogen, Urea, Uric Acid, Creatinin, and Sugar per 100 cc. of Blood, by C. E. Hayden and M. Tubangui (pp. 181–192); The Bacterial Content of the Genital Tract of Cattle, and Its Relation to Calf Infection, by C. M. Carpenter (pp. 193–202); A Study of Cloacitis in the Domestic Fowl, by S. A. Goldberg and J. P. Benson (pp. 203–222); Treatment of Side-Bone (Ossification of the Lateral Cartilages) by Shoeing, by H. Asmus (pp. 223, 224); and Hog Cholera, by R. R. Birch (pp. 225–235).

Report of the veterinary service for the year 1918–19, W. Littlewood et al. (*Egypt Min. Agr., Vet. Serv. Ann. Rpt., 1918–19, pp. 39.*)—The first part of this report deals with the occurrence of and work with infectious diseases of live stock, the second part with the work of the veterinary pathological laboratory, and the third part with the work of the School of Veterinary Medicine. A census report on the domestic animals in Egypt during 1918 as compared with 1917 is appended, together with returns of animals slaughtered in abattoirs.

Annual report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1919–20, P. J. Kerr and A. D. MacGregor (*Bengal Vet. Col. and Civ. Vet. Dept. Ann. Rpt., 1919–20, pp. 4+II+7+IX+2*).—The usual annual report (E. S. R., 42, p. 675).

Annual administration report of the Bombay Veterinary College and Civil Veterinary Department in the Bombay Presidency (including Sind), M. H. Sowerby, G. Taylor, and E. S. Farbrother (*Bombay Vet. Col. and Civ. Vet. Dept. Ann. Admin. Rpt., 1919–20, pp. 41*).—This is the usual annual report (E. S. R., 43, p. 272).

Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1919–20, F. Ware and D. A. D. Aitchison (*Madras Civ. Vet. Dept., Ann. Admin. Rpt., 1919–20, pp. 20*).—The usual annual report (E. S. R., 43, p. 180).

Annual report on the Punjab Veterinary College, Civil Veterinary Department, Punjab, and the Government Cattle Farm, Hissar, for the year 1918–19, H. T. Pease, J. Farmer, et al. (*Punjab Vet. Col. and Civ. Vet. Dept. Ann. Rpt., 1918–19, pp. III+2+18+XVII*).—The usual annual report (E. S. R., 40, p. 676).

The principles of serum and vaccine therapy, S. H. Gaiger (*Vet. Rec., 33 (1921), No. 1698, pp. 65–69*).—A general discussion of active and passive immunity and of the use of serum and vaccine alone and combined for the production of active and passive immunity.

The transmission of specific immune bodies from the mother to the young, K. M. Howell and H. Eby (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 550–556*).—This study includes experiments on the effects of parturition on the antibody content of the serum of immune rabbits and their offspring, and the duration of immune bodies in the serum of the offspring. Six rabbits, before pregnancy, were immunized, one each against human blood corpuscles, sheep corpuscles, *Streptococcus vividans*, type 2 pneumococcus, meningococcus, and *Bacillus typhosus*. A high degree of immunity was maintained by weekly injections of the immunizing agent during pregnancy, the injections being discontinued after parturition. The serum from two rabbits and their young was examined at weekly intervals for hemolytic amboceptor, serum from four rabbits and their young for bacterial complement fixing bodies, serum from two rabbits and their young for bacterial agglutinin, and serum from one rabbit and its young for opsonin.

Antisheep and antihuman hemolysin was decreased in immunized rabbits after parturition, complement fixing antibodies almost disappeared in all but one of the four rabbits tested, agglutinin decreased in one and remained constant in one, and opsonin decreased in the one rabbit tested. The serum of the young of these rabbits showed in the same order a small amount of hemolysin which decreased rapidly, complement fixing bodies in one case only, some agglutinins but less than in the mother, and low points of opsonic extinction but a persistence of opsinin after 5 weeks. The complement fixing antibodies appeared to be less stable than the other immune bodies studied and less readily transmitted to the young.

A comparison of antigens for bacterial complement fixation, K. M. Howell and R. Anderson (*Jour. Infect. Diseases, 27 (1920), No. 6, pp. 569–575*).—Eight different antigens prepared by various methods were compared as to specificity, anticomplementary and antigenic properties and antigenic range in rabbits immunized against the same bacterial strains that were used for the antigens.

A simple antigen prepared by heating the washed suspension of bacteria in normal salt solution was found to be as satisfactory as the more complicated antigens. The authors are of the opinion, however, that the diversity in the choice of the most satisfactory antigen for different bacteria is such as to make it advisable, before starting an extended bacterial complement fixation study, to determine the antigen best suited for the bacteria used in the test.

Foot-and-mouth disease, G. Moussu (*Rec. Méd. Vét., 96 (1920), No. 7–9, pp. 193–208*).—The author discusses the epidemic of foot-and-mouth disease in Italy and other European countries during 1919–20 and reports the results of attempts to control and ameliorate the disease by immunization methods. These consisted first in hyperimmunizing, by means of repeated subcutaneous inoculation of citrated virulent blood, heifers recently cured of the disease, and using the serum from these animals both as a curative and preventive agent. In the former case subcutaneous or intravenous injections of 50 cc. each of the serum were without effect, the disease in all cases taking its normal course. Subcutaneous injections of the serum into normal animals exposed to the disease postponed the appearance of the disease for about 17 days, thus indicating the production of a very transient immunity.

In a series of experiments in which both serum and virulent blood (2 cc.) were injected simultaneously, the period of incubation was extended on an average to 29 days. In another series in which the virulent blood was injected intravenously the day following the subcutaneous injection of the serum, no signs of the disease appeared beyond an intense fever for several days following the inoculation. This suggested the use of intravenous injections of virulent blood as a substitute for the old method of inocculation by mouth. Experiments reported by collaborators of the author indicated that the intravenous injection of citrated virulent blood can be made without danger, and that such injections, while apparently having no effect on subjects already showing visible signs of the disease, if practiced on apparently well animals produce a benign form of the disease. This method of control is considered the most promising in view of the experiments reported.

The adsorption of the virus of foot-and-mouth disease, H. Vallée and H. Carré (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 3, pp. 185–187*).—The authors report that after shaking a mixture of red blood cells with a suspension of aphthic ephithelium in physiological salt solution the virus is adsorbed by the cells, as shown by the ability of the washed cells to produce the disease on subcutaneous inoculation in cattle. After keeping such cells for 48 hours at temperatures of from 0 to 2° C. they are easily phagocytized by the

white corpuscles. Although a single inoculation of the adsorbed virus did not suffice to immunize experimental animals, the authors are of the opinion that this property of adsorption is of considerable significance in suggesting the existence of intraglobular virus in infections in the course of which the microscope does not reveal the existence of a causative organism, and of making it possible to obtain for different diseases caused by filterable viruses phagocytable suspensions suitable for immunization experiments.

Foot-and-mouth disease (*Lancet* [*London*], *1921, I, No. 5, pp. 231, 232*).—This is an editorial discussion of the symptoms, cause, and treatment of foot-and-mouth disease, with a brief history of its appearance at various times in England and of the measures taken there to check and exterminate it.

The treatment of epizootic lymphangitis by heated cultures of cryptococci, Forgeot (*Bul. Soc. Cent. Méd. Vét., 96 (1920), No. 22–24, pp. 489–496*).—The author treated epizootic lymphangitis by subcutaneous injections at 8-day intervals of an emulsion of cryptococci heated at 65° C. for 1.5 hours and diluted in physiological salt solution to a dose of 5 mg. per cubic centimeter. The doses increased by 1 cc. each from 1 to 5 cc., the average duration of treatment being 57 days. Of the 20 horses thus treated 13 were completely cured, while the other 7 showed no benefit. The author is of the opinion that the procedure, while not universally successful, is at present the method of choice.

Method of preparation and antigenic power of alcoholic extracts of tubercle bacilli, A. Bouquet and L. Nègre (*Compt. Rend. Soc. Biol.* [*Paris*], *83 (1920), No. 21, pp. 922–924*).—In the method described sterilized, washed, and desiccated tubercle bacilli are subjected at room temperature for 24 hours to the action of acetone in the proportion of 0.001 gm. of the desiccated bacilli to 1 cc. of acetone. The mixture is then filtered, and the bacilli, after drying in the oven, are mixed with an equal volume of 96 per cent alcohol and are shaken at intervals for 48 hours and filtered.

The alcoholic extract thus prepared is said to possess a much higher antigenic power than the direct alcoholic extract. In aqueous solution, 1 : 10, it resists heating at 100° for 15 minutes. After evaporating the alcohol there remains a light grayish-white deposit insoluble in physiological salt solution in which is formed, on shaking, an emulsion of feeble antigenic power. If the precipitate is redissolved in alcohol, a liquid is obtained of the same activity as the original alcoholic extract.

Combating bovine tuberculosis with vaccination, A. Eber (*Ztschr. Tuberkulose 27 (1917), No. 1–4, pp. 263–316*).—This is an extensive review and discussion of the literature on attempts at immunization of cattle against tuberculosis. The conclusion is drawn that there is at present no method of immunization which confers a sufficient immunity against natural tuberculous infection. A list of 295 references to the literature, covering a period through 1914, is appended.

A pleomorphic bacillus from pneumonic lungs of calves simulating Actinomyces, T. Smith (*Jour. Expt. Med., 28 (1918), No. 3, pp. 333–344, pls. 4*).—This is a report of investigations during the winter of 1917 of a disease of young calves, in which a bacillus was found associated in pure culture with an extensive lobar broncho-pneumonia in calves over four weeks old. This bacillus occurred in the exudate as a minute bacillus in small groups. In cultures it appeared in three forms, namely, as a bacillus, as a coccus-like endospore or arthrospore, and as a conglomerate Actinomyces-like flake or colony with peripheral clubs. It was not appreciably pathogenic when injected into certain small laboratory animals. The author suggests the name *Bacillus actinoides* for it, and leaves it to future investigations to determine whether or not it is specifically identical with Lignières actino-bacillus.

The etiological relation of Bacillus actinoides to broncho-pneumonia in calves, T. SMITH (*Jour. Expt. Med., 33 (1921), No. 4, pp. 441–469, pls. 9, figs. 7*).—This is a report of investigations in continuation of those above noted, conducted during the course of an outbreak of pneumonia among calves belonging to a dairy herd in which about 100 calves are raised annually.

"A broncho-pneumonia of calves in the early months of life is described and its etiology associated definitely with a minute bacillus, *B. actinoides. B. pyogenes, B. bovisepticus,* and, less frequently, staphylococci and streptococci may appear later in the affected lungs. Subcutaneous injections of cultures of *B. actinoides* produce large indurations ending in necrosis. Similarly intratracheal injections produce circumscribed necroses of lung tissue. The cultivation of *B. actinoides* and its morphological peculiarities have been sufficiently described and illustrated in an earlier publication to insure success on the part of those who attempt to isolate it."

Experiments on the vaccination of sheep, H. A. GINS (*Ztschr. Hyg. u. Infektionskrank., 90 (1920), No. 2, pp. 322–336*).—The author reviews briefly the literature on the vaccination of sheep against sheep pox, and reports results from his own experience indicating that vaccination with sheep-pox virus is entirely feasible, leads to no generalization of the virus but only local manifestation, and results in a protection against fatal doses of the sheep-pox virus.

Two methods of vaccination are recommended, subcutaneous injection and inhalation of fresh virus. The latter method is thought to offer considerable promise as a rapid means of vaccinating a large number of sheep. The possibility is suggested of accomplishing this by placing a number of sheep in a small chamber and saturating the air with the virus by the use of an automatic spraying device operated from without.

Protozoan forms and their relation to diarrhea and colitis in shotes, W. W. DIMOCK (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 4, pp. 413–426, figs. 2*).—In studies made by the Kentucky Experiment Station of a disease of shotes, which is apparently the same as the condition commonly classified as intestinal necrobacillosis, infectious necrotic enteritis, infectious colitis, infectious diarrhea, etc., careful examination of the bowel content indicate that certain protozan forms may be important factors in initiating the disease. Microscopic examinations of the intestinal contents have been made of 75 pigs, and the organisms encountered have been identified as *Balantidium coli suis* and *Trichomonas suis.* In considering the evidence, it is concluded that there is quite as much to show that *T. suis* is the primary cause of the disease (infectious colitis) as there is for any of the different bacteria that have been studied.

Investigations of the occurrence of the shote typhoid bacillus in healthy swine and in swine affected with hog cholera, E. TORMANN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1919), No. 7, pp. 532–559*).—This is a contribution on the question of the primary pathogenicity of this microorganism and on the occurance of bacteria of the colon typhoid group in swine.

Determination of the total volume of erythrocytes and leucocytes in the blood of the horse by means of the hematocrit, L. MONTANDON (*Recherches sur le Volume Total des Erythrocytes et Leucocytes dans le Sang du Cheval à l'Aide de l'Hématocrite. Inaug. Thesis, Univ. Bern, 1919, pp. 25*).—An inaugural thesis in which the variation in percentage of the blood corpuscles found in horses of different ages and sexes is reported upon.

Equine vaccine and serum therapy, H. T. HUGHES (*Vet. Rec., 33 (1921), No. 1704, pp. 193–198*).—This is a general discussion of vaccine and serum

therapy with special reference to equine diseases. The article closes with a brief survey of work done along these lines in the British Expeditionary Forces in France.

Blood findings in pulmonary emphysema of horses, E. AUGSBURGER (*Blutbefunde beim Lungendampf des Pferdes. Inaug. Diss., Univ. Bern. 1919, pp. 32*).—This inaugural dissertation reports studies of the blood made in emphysema of the lungs of horses, and includes a list of 25 references to the literature.

A new strain of transmissible leukemia in fowls (strain H), V. ELLERMANN (*Jour. Expt. Med., 33 (1921), No. 4, pp. 539–552, figs. 3*).—"A new strain of fowl leucosis has been transmitted through 12 generations of fowls. An increase in virulence was observed during its passage. This was shown in a shortening of the interval between innoculation and death. The increase in virulence does not affect the number of successful inoculations, which remains approximately constant in from 20 to 40 per cent of the birds employed.

"As with former strains, the disease manifests itself in various forms; i. e., myeloid and intravascular lymphoid types. A single lymphatic case was observed. In several intravascular cases a diminution in the hemolytic power of the serum was established. This phenomenon was absent in a number of myeloid cases.

"Active immunization can not be produced by means of the subcutaneous injection of virulent material. The finding of previous experiments that the virus is filterable has been confirmed. The inoculation of human leucemic material into fowls gave negative results."

Tuberculosis of fowls, B. A. GALLAGHER (*U. S. Dept. Agr., Farmers' Bul. 1200 (1921), pp. 11, figs. 3*).—This is a popular summary of information in which the nature and importance of this affection in fowls are pointed out.

Observations on the effect of ipecac in the treatment of infectious entero-hepatitis (blackhead) in turkeys, H. M. and P. WEGEFORTH (*Jour. Pharmacol. and Expt. Ther., 17 (1921), No. 3, pp. 249–259*).—Investigations by the authors at San Diego, Calif., are said to have demonstrated that infectious entero-hepatitis of turkeys can be cured by the administration of suitable doses of ipecac. "It has also been shown that in turkeys experimentally infected by the feeding of viscera taken from a turkey succumbing of the disease can be prevented from contracting the disease by either the oral administration of the fluid extract of ipecac or by the ingestion of the powdered drug with the food. Further, it can be said that the disease failed to make its appearance among the turkeys on a ranch which for several years previous had been visited by epidemics of the disease in a virulent form, the prevention being attributed to the prophylactic administration of ipecac with the food.

"A routine was established on the ranch whereby any bird showing symptoms of blackhead was immediately separated from the rest of the flock and given by mouth ten drops of the fluid extract of ipecac three times a day. This dosage was continued for three days, after which it was decreased to 10 drops twice a day for three days and later once a day for the same period. After treating 6 or 8 turkeys with ipecac, we found that instead of needing autopsies the birds were recovering and could later be turned back with the flock. Of the 52 young birds forming our supply of clinical material, 32 were attacked by the disease. Under the ipecac treatment, 29 of these recovered completely, making a mortality of less than 9 per cent. Of 5 of the old birds contracting the disease during the same period 3 were cured while 2 were lost; those lost were very severe cases, almost fulminating in character, and succumbed in less than two days. Twenty of the young birds never contracted the disease."

A remedy for mange in white rats, C. KENNEDY (*Science, n. ser., 53 (1921), No. 1372, p. 364*).—Experiments at the Minnesota Experiment Station have shown that pine oil applied with a soft brush will cause the parts affected with *Notoedres alenis* to heal very quickly.

Some observations and experiments on insect flagellates, with special reference to artificial infection of vertebrates, C. A. HOARE (*Parasitology, 13 (1921), No. 1, pp. 67–85*).—In experiments on artificial infection of mice with *Crithidia melophagia, Herpetomonas jaculum,* and *H. calliphorae,* the author was unable to confirm the results obtained by A. Laveran and his collaborators, finding no traces of infection or of the presence of any forms of flagellates in the animals experimented upon.

RURAL ENGINEERING.

The development of institutions under irrigation, G. THOMAS (*New York: Macmillan Co., 1920, pp. X+293, pls. 2*).—The purpose of this book is to relate the story of the development of irrigation institutions, particularly in the State of Utah. Special attention is drawn to the early history of such development. Chapters are included on individual, partnership, and community canals in early days; the land system; water legislation, 1849–1880; county courts and the control of irrigation water; city control of water; irrigation districts; county water commissioners; district or trial courts and irrigation; supreme court decisions and irrigation; thirty-eight years of irrigation legislation; the Bear River Canal; State irrigation projects and State assistance of private projects; the Carey Act; the Reclamation Service; drainage; and the legislation of 1919.

Report of the Water Conservation and Irrigation Commission for the year ended June 30, 1920 (*N. S. Wales Water Conserv. and Irrig. Comm. Rpt., 1920, pp. 44*).—This report contains data on irrigation areas established and controlled by the State, irrigation schemes under consideration, water conservation works constructed by the State, national works maintained by the commission, artesian and shallow well boring, and licensed works for stock and domestic water supply, irrigation, and other purposes.

The application of water in irrigation, A. C. JENNINGS (*Rhodesia Agr. Jour., 18 (1921), No. 1, pp. 56–64, figs. 7*).—Practical information on the laying out and preparation of land in a suitable manner for irrigation and on the application of irrigation water with reference to conditions in Rhodesia is given.

Quality of irrigation water in relation to land reclamation, C. S. SCOFIELD and F. B. HEADLEY (*Jour. Agr. Research [U. S.], 21 (1921), No. 4, pp. 265–278*).—Studies conducted by the Bureau of Plant Industry of the U. S. Department of Agriculture on the action of irrigation waters, containing excessive quantities of salts, on soils are reported and discussed.

Attention is drawn to certain irrigated soils which are impervious to water and become hard and difficult to work when dry. As a result of the present investigation the conclusion is reached that the trouble with these soils is not due to sodium carbonate exclusively, but that it may be induced by the so-called neutral salts of sodium as well. When soils containing excessive quantities of sodium chlorid or sodium sulphate were leached with pure water, similar results were produced as when such soils were irrigated with water containing sodium carbonate.

It was also found that this injurious effect of sodium salts is much reduced if the salty soil is first leached with a solution of some salt of calcium or aluminum. A soil so treated may be subsequently leached with pure water

without developing the symptoms of a reduced permeability and an alkaline percolate. If the irrigation water contained calcium salts equal to or in excess of the sodium salts, the soil rendered salty by such water was less likely to become impermeable when subsequently leached with pure water or with water containing these salts in the same proportion but in lower concentrations.

The further conclusion is drawn that the quality of irrigation waters should be judged not only by considering the total quantity of the salts in solution or the proportions of the acid radicles, but also the proportion of the sodium to the calcium and magnesium. It is suggested that water, to be safe for long-continued irrigation, should be relatively rich in calcium and magnesium.

Water power in the Union of South Africa, I–III, F. E. KANTHACK (*So. African Jour. Indus., 3 (1920), Nos. 8, pp. 717–733; 9, pp. 794–802; 10, pp. 927–932, figs. 2*).—A general review is given of the available water power resources of the Union of South Africa.

Part 1 deals with the topography of South Africa and the hydrographic conditions of the Union, and estimates the volume of water which can be used for future extensions of irrigation. In part 2 data are presented on the area of land at present irrigated and the area capable of being irrigated in the future. The total area irrigated is about 1,373,518 acres, and the area estimated to be potentially irrigable after 1930 is about 1,482,700 acres. Attention is drawn to the premier claim of agriculture for irrigation water, and the conflicting claims of irrigaton and water power, the unsuitableness of irrigation storage works for water-power schemes, and possible sources of water power are discussed. In part 3 the cost of storage and coveyance of water is discussed in detail.

Water-power schemes for the Union, F. E. KANTHACK (*So. African Jour. Indus., 3 (1920), Nos. 11, pp. 1043–1051; 12, pp. 1131–1141*).—In the first part of this article the water-power possibilities of some 50 of the rivers of the Union of South Africa are discussed, together with an outline of the water law of the Union relating to power development. Part 2 deals with the water-power possibilities of the Vaal and Orange Rivers.

Hydraulics of the Miami flood-control project, S. M. WOODWARD (*Miami [Ohio] Conserv. Dist., Tech. Rpts., pt. 7 (1920), pp. 343, pl. 1, figs. 125*).—This report embraces the considerations determining the decision as to the type of protection system to be adopted on the Miami flood-control project and the general matters of a hydraulic nature necessary to be used in the design of structures.

The order of presentation shows (1) the general nature of the problem in the Miami valley, (2) a general comparison of the various flood protection plans considered, (3) a more detailed description of the adopted plan, the way it will function in practice, and its effect upon the activities of the valley, and (4) a thorough detailed technical discussion of the principles, theories, and methods of making the voluminous hydraulic calculations required in developing the details of the plan. These embrace especially the capacities of retarding basins, the flow through outlet conduits, the methods of predicting the effects of retarding basins upon definite floods, the determination of the size of dams, outlets, and spillways, the principles governing the design of channel improvements, and the proper coordination of the different retarding basins and channel improvements.

Contract forms and specifications, A. E. MORGAN ET AL. (*Miami [Ohio] Conserv. Dist., Tech. Rpts., pt. 6 (1918), pp. 192, pls. 3*).—This report brings together the legal documents and specifications prepared for letting the contracts for construction of the Miami Conservancy District.

Results of run-off experiments with muck soil (*Engin. and Contract., 55 (1921), No. 15, pp. 363–365, figs. 1*).—This is an abstract of a paper presented by F. C. Elliott before the Florida Engineering Society, in which experiments on the determination of run-off from muck soils, such as occur in the Florida Everglades, are reported. The principal factors studied were storage and evaporation of moisture, the most advantageous water level for growing crops, and subsidence of muck soils under drainage and cultivation. The apparatus used consisted of a water-tight sheet-iron box 2 ft. square and 4 ft. deep, filled with a section of muck soil in its natural condition, growing grass.

It was found that muck soil has a very important storage capacity for moisture when the water table is at a favorable level. The records of the soil boxes showed in the beginning on virgin muck soil that each 3 in. of soil above water leved was capable of storing 1 in. of rain. Later, after the soil became more compact by tillage and drainage, the storage factor was reduced 1:4, and finally to the ratio of 1:5, which latter has been maintained for the past three years. It is concluded (1) that the storage capacity of muck soil is a drainage factor of considerable value, varying directly as the depths of soil above the water table; (2) that in designing a drainage system for muck land account may be taken of the storage value of the soil, provided ditches of relatively deep section are used and at sufficiently close intervals to secure a good depth of water table and for restoring and preserving the storage value of the soil; (3) that soil storage tends to equalize run-off, and its effect will extend to the main canal system as well as to the lateral system; and (4) that deep soil above the water table is a great protection against flood.

Leveling data showed that subsidence varying in amount from 2 to 3½ ft. took place during six years on drained land in the upper Everglades. Subsidence apparently takes place from the surface downward and is confined almost entirely to the zone above water level. Ditch capacity is reduced by diminished depth and slope. The lower the water table the greater and more rapid was the subsidence, and vice versa. The data indicate that too deep drainage should be guarded against, not only from the standpoint of subsidence but also because muck was found to resist the reabsorption of moisture once it becomes too dry. The kind and intensity of cultivation also affected the amount and rate of subsidence.

On the basis of these studies a drainage layout is suggested for such soils, in which drainage capacities are represented by the equation $D=\frac{12}{1+\sqrt{A}}+16$, in which D is the discharge in cubic feet per second per square mile and A is the area in square miles. In this layout the maximum water level in ditches is to be 1 ft. below the ground surface, the depth of lateral ditches not less than 5½ ft., and their spacing not over ½ mile. The water level is to be reduced before the beginning of the rainy season to not less than 50 in. below the surface. The depth of farm ditches is to be not less than 4½ ft. and the spacing not over 660 ft. "In virgin muck soil 8 ft. or more in depth the ditches should be cut 8 ft. deep in order to have as much as 5½ ft. after three or four years of drainage and cultivation. This minimum depth of 5½ ft. must be preserved, and can be through maintenance from time to time. Where partial subsidence has already taken place allowance may be made accordingly. Ditches within reasonable limits and where practicable should be deep and narrow rather than broad and shallow."

Fourth report of State highway engineer and State engineer of New Mexico, L. A. GILLETT (*N. Mex. Highway and State Engin. [Bien.] Rpt., 4 (1919–20), pp. 108, pls. 25, fig. 1*).—Data are reported and discussed on the

work and expenditures of the offices of the State highway engineer and State engineer of New Mexico for the period from December 1, 1918, to November 30, 1920.

Eighth biennial report of the State highway commissioner for the period October 1, 1918, to September 30, 1920, J. ALLEN (*Wash. State Highway Commr. Bien. Rpt., 8 (1919–20), pp. 169, pls. 10*).—This report contains data on the work and expenditures of the Washington State Highway Commission for the biennial period from October 1, 1918, to September 30, 1920.

Subgrade testing apparatus used by Illinois Highway Department, H. F. CLEMMER (*Good Roads, n. ser., 21 (1921), No. 13, pp. 181, 182, figs. 3*).—A description is given of the apparatus and methods used on the Bates experimental road in studying subgrade conditions and behavior of the pavement. These include subgrade testing cylinders and a device for reading the change in position of the bearing plug which follows the downward movement of the pavement and the upward movement of the subgrade.

Investigations on fundamental principles in wood conservation, F. MOLL (*Untersuchungen über Gesetzmässigkeiten in der Holzkonservierung. Jena; Gustav Fischer, 1920, pp. [3]+23*).—Studies on the action of inorganic compounds on the fungi which cause decay in wood are reported, the purpose being to establish the fundamental principles of such action as related to the treatment of wood for preservation.

It was found that the poisonous action of salts against wood-destroying fungi is an additive action of the ions. The poisonous ions tested were found to be in the order of their effectiveness, mercury, silver, cadmium, cyanid, copper, zinc, iron, cobalt, chromium, and fluorin. Magnesium and aluminum ions, considered to be the most alkaline and acid ions, respectively, were practically ineffective. The poisonous action was found to depend on the solubility in water of the salt and its ability to disassociate into ions in solution. Each ion possessed a specific poisonous action as well as ability to enter into a specific reaction. The effectiveness of compound ions was found to depend upon the individual action of each of their constituents.

Mixing of other salts with active compounds retarded disinfection or hastened it, but did not influence the final results. The effectiveness of a given quantity of a soluble salt or salt mixture was found to depend solely upon the quantity of active constituents in the solution or mixture and on their specific effectiveness.

It is concluded that these experiments place the use of salt mixtures for the impregnation of wood as a protection against decay and fire on a new scientific basis. As long as the mixed salts do not form insoluble precipitates or complex compounds, each individual ion is concluded to retain its specific effectiveness unchanged, and the effectiveness of the mixture as a whole can be considered as the sum total of the effectiveness of the individual ions or molecules.

The penetration of creosote in various sizes of sawed lumber and round piling, R. H. RAWSON (*Amer. Wood Preservers' Assoc. Proc., 16 (1920), pp. 74–77, figs. 4*).—Mathematical and graphic data are presented on the relation existing between the shape of a piece of Douglas fir timber and the depth of penetration on treatment with a given amount of creosote oil. The formula for the penetration of creosote in various sizes of sawed lumber is derived and presented as follows:

$$t=\frac{\frac{b+d}{2}-\sqrt{\left(\frac{b+d}{2}\right)^2-\frac{Pbd}{45.818}}}{2}$$

in which b, d, and t represent the width and depth of the lumber and the depth of penetration in inches, respectively, and P represents the pounds of creosote per cubic foot of wood. A corresponding formula for round timber is presented as follows:

$$t = \frac{D - \sqrt[2]{D^2 - \frac{PD^2}{45.818}}}{2}$$

in which D represents the average of the diameters at top and butt.

Effect of storage of cement, D. A. ABRAMS (*Lewis Inst. Struct. Materials Research Lab. Bul. 6 (1920), pp. 28, figs. 10*).—Tests on the effect of storage for periods up to two years of three different lots of Portland cement in different kinds of packages and under different conditions on its concrete and mortar-making properties are reported.

The cements were stored (1) in the laboratory, (2) in the basement of the building, and (3) in a shed in the yard, usually in lots of from 800 to 1,200 lbs. in standard cloth sacks. In one group of tests two brands of paper sacks were also used, and in another group the cloth sack containers were covered with thin layers of either Portland cement or hydrated lime. Tests were made at ages of 7 and 28 days, 3 months, and 1 and 2 years on samples taken immediately upon receipt from the dealer's warehouses and after storage for 3 and 6 months and 1 and 2 years.

The report includes the results of compression tests of about 1,000—6 by 12 in. concrete cylinders, about 1,000—2 by 4 in. cylinders of 1:3 standard sand mortar, and about 500 miscellaneous tests. Tests have been under way for 3½ years. It was found that there was no essential discrepancy between the results of compression tests of 1:5 concrete in the form of 6 by 12 in. cylinders and those of tests on 1:3 standard Ottawa sand mortar in 2 by 4 in. cylinders.

Compression tests of concrete and mortar showed a deterioration in strength with storage of cement for all samples, for all conditions and periods of storage, and at all test ages. The deterioration was greatest for the samples stored in the shed in the yard and least for the samples stored in the laboratory. The basement storage was nearly as severe as that outdoors. The deterioration was greater during the first three months than for the later 3-month periods. A greater deterioration was found in the tests made at the age of 7 days than at 28 days and later test ages. After three months' storage in the shed in the yard, the cement had 80 per cent of its original strength, after six months' storage 71 per cent, after one year's storage 61 per cent, and after two years' storage 40 per cent. The deterioration was probably greater in these tests than would be found in a larger lot of cement stored under similar conditions.

The effect of storage of cement on the concrete or mortar strength seemed to be largely a question of the age at which concrete or mortar is tested. The average concrete strength of cement stored in the shed in the yard when tested at 7 days (for all periods of storage) was 64 per cent of the strength when received from the warehouse, at 28 days 71 per cent, at 6 months 78 per cent, at 1 year 82 per cent, and at 2 years 85 per cent. A somewhat similar relation was found for other storage conditions. It is considered a matter of the utmost importance to note that the strength of concrete is not permanently reduced to the low values found in the 7 and 28 day tests.

For periods up to 1½ years there was no marked difference in the quality of cement stored in cloth and in paper sacks. The two brands of paper sacks gave almost identical results. Only a slight advantage was found from the protection of cement in cloth sacks which were covered by thin layers of cement or hydrated lime.

The most favorable storage condition (in laboratory) and the least favorable (in basement and shed) gave strengths of the same order of magnitude, indicating that the possibilities of improving the storage condition of cement in sacks in this climate is rather limited. Storage of cement prolonged the time of initial and final setting, but only slightly affected the normal consistency. The deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing a partial hydration, which exhibits itself in reducing the early strength of the concrete and in prolonging the time of setting.

Only a negligible quantity of lumps were formed up to one year's storage. Tests on concrete using only broken lumps of cement gave considerable strength.

Brief discussions of storage of cement on the work and a bibliography on the effect of storage of cement are given.

Determination of the mechanical efficiency of internal-combustion engines, V. L. MALEEV (*Gas Engine, 23 (1921), No. 3, pp. 53–58, figs. 5*).—A number of studies on methods for determining the mechanical efficiency of internal combustion engines are described, and related factors, including apparatus, are discussed.

Résumé of [U. S.] Bureau of Standards fuel study, H. C. DICKINSON (*Jour. Soc. Automotive Engin., 8 (1921), No. 5, pp. 482–486, figs. 6*).—These studies have included work on fuel characteristics and economy and detonation.

Studies of characteristics and economy with three different grades of gasoline, including aircraft gasoline, commercial gasoline, and aviation gasoline containing about 15 per cent of kerosene showed that under the conditions of the test there was no significant difference in the total consumption of the three fuels when delivering the same number of horse-power hours under the same conditions.

The studies of detonation led to the conclusion that whatever the nature of detonation it is largely dependent upon the timing of the explosion with respect to the position of the piston. This means the regulation of the time at which the maximum rate of burning takes place.

[Official gasoline and kerosene analyses, 1920], R. E. ROSE and E. T. CASLER (*Fla. Dept. Agr. Quart. Bul., 31(1921), No. 1, pp. 152–285*).—This section of this report contains the results of official analyses of 1,197 samples of gasoline and 414 samples of kerosene collected for inspection in Florida during 1920, and special analyses of 14 samples of gasoline sent in by firms and individuals.

Implements and machinery, G. S. HENDERSON (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 18–26*).—The details of accomplishment, fuel consumption, and working costs, including all expenses except depreciation and interest, of a steam plowing tackle and two tractors, covering a period of one year in India, are presented and discussed.

Tractor and implement blue book (*St. Louis: Midland Pub. Co., 1921, pp. 359, figs. 179*).—This is a standard buyers' guide for farm implements and machinery of all kinds.

Nebraska tractor tests, O. W. SJOGREN (*Jour. Soc. Automotive Engin., 8 (1921), No. 5, pp. 391–395, figs. 6*).—The important features of the tractor tests conducted at the University of Nebraska are reviewed and typical results summarized to show the weaknesses exhibited by the tractors tested.

The difficulties encountered by tractors are classified into five divisions as (1) engine troubles, which are dependent upon the design of the engine and the correlation of different parts, (2) accessory troubles, which depend upon the choice of the proper accessories and their adaptation to the engine, (3) proper correlation of the parts and the design of the chassis to fit the engine and permit

its most efficient use, (4) testing of finished tractors by others than designing engineers to bring out minor difficulties, and (5) rating the tractors to give a liberal allowance for overload.

The Nebraska tractor law and rules for official tractor tests, O. W. SJOGREN, E. E. BRACKETT, C. W. SMITH, and F. R. NOHAVEC (*Nebraska Sta. Circ. 13 (1921), pp. 8, figs. 1*).—This is a revision of Circular 10 of the station (E. S. R., 42, p. 784).

Comparative experimental studies on hay and silage cutters, M. CONTI (*Rev. Facult. Agron. y Vet. Buenos Aires, 3 (1920), No. 2, pp. 138–148, figs. 5*).—Studies made in connection with work in progress at the National University of Buenos Aires on the development of the most rational type of knife for hay and silage cutting are reported.

Two general types of cutter are distinguished—(1) those with the knife mounted on a circular revolving frame at right angles to the axis of rotation and (2) those with the knife mounted on a revolving cylinder parallel to the axis of rotation. Tests of four cutters, two of each type, are described. The two right angle cutters and one of the cylinder cutters were of the hand-operated type, and the fourth cutter was a large engine or motor-operated type. One of the right angle cutters had two straight blades and the other had two curved blades of so-called logarithmic spiral shape. The hand-operated cylindrical cutter had one helicoidal shaped blade and the motor-operated cutter two helicoidal shaped blades. The respective operating speeds were 50 to 60, 50 to 60, 100, and 600 r. p. m., and the respective maximum diameters of revolution were 27, 42, 7.3 and 10 in. The knife lengths of the cylinder cutters were 11 and 10.6 in., respectively.

The tests were conducted with dry corn. The quantity of cut stalks from the first three cutters varied with the speeds from 295 to 550 lbs. per hour. Ten stalks were fed at a time to these cutters and 15 stalks to the motor-operated cutter. The amount of mechanical energy utilized by each cutter is shown in the following table:

Mechanical energy absorbed by silage cutters.

Cutter.	R. p. m.	Lengths of cut.	Energy absorbed in cutting.	Energy absorbed at each cut.	Energy absorbed running empty.	Cuts per second.	Cutting force at knife edge.
		Inches.	*Foot-pounds.*	*Foot-pounds.*	*Foot-pounds.*		*Pounds.*
No. 1	64	1.6	171.0	77.3	48.8	2.2	44.0
Do	100	1.6	94.6	28.4	.....	3.3	14.5
Do	100	.8	97.3	29.6	.....	3.3	
No. 2	64	.8	123.0	55.4	64.9	2.2	29.0
Do	100	.8	73.0	22.2	.....	2.2	10.5
No. 3	100	1.6	77.0	45.6	73.0	1.6	24.0
Do	240	1.6	61.0	15.2	.....	4.0	8.0
No. 4	600	1.2	723.0	36.2	97.5	20.0	30.0

The mechanical energy absorbed by the three hand-operated cutters was inversely proportional to the speed. About twice as much energy was required by the hand cylinder cutter per cut as by the two other hand machines when operating at the same speed. The spiral-shaped knife cutter was superior to the straight knife cutter. The length of cut apparently did not influence the energy requirements.

The results are taken to indicate the advantage of cutters Nos. 2 and 3, and also the necessity of establishing a definite relation between the geometric form of the knife, a convenient peripheral speed, and the weight of the frame.

Handbook of building construction, G. A. Hool and N. C. Johnson (*New York and London: McGraw-Hill Book Co., Inc., 1920, vols. 1, pp. XLIV+802, figs. 1016; 2, pp. [2]+803–1474, figs. 407*).—This work in two volumes is intended to provide the architect, engineer, and builder with a reference covering the design and construction of the principal kinds and types of modern buildings and their mechanical and electrical equipment.

Part 1 deals with design and construction, part 2 with estimating and contracting, and part 3 with mechanical and electrical equipment. Part 1 contains sections on structural theory, designing of structural members and connections, structural data, general designing data, construction methods and equipment, and building materials.

Temperature not affected by ventilation, R. L. Patty (*Swine World, 8 (1921), No. 16, pp. 9, 39*).—In a contribution from the South Dakota Experiment Station, the author describes a test conducted by the farm building ventilation committee of the American Society of Agricultural Engineers on a hog house 80 by 28 ft.

It was found that with over 1,200 cu. ft. of air circulating through the house every minute of the night, changing the air completely every 16 minutes, the temperature remained practically constant although the outside temperature dropped 4 or 5°. There was a difference of from 18 to 25° between the outside and inside temperatures. The house is of the type having low side walls, comparatively low overhead space, and large continuous skylight windows. There were 19 small outside doors opening out of the pens and one opening into an adjoining building. Eight of these doors were doubled on the west part. There were six fresh-air-inlet flues 9 in. in diameter on each side and three pairs of 15-in. out-take flues extending up to three large aerators on top.

Hygrometer readings showed that there was practically no excess moisture in the air. It was also found that the suction effect of the aerators on top was not necessary to maintain air circulation, although it had a decided influence.

RURAL ECONOMICS AND SOCIOLOGY.

Rural problems in the United States, J. E. Boyle (*Chicago: A. C. McClurg & Co., 1921, pp. 142*).—In this book, one of the National Social Science Series edited by F. L. McVey, the author discusses broadly certain rural institutions, the home, the school, the country church, store, bank, and newspaper, and the farm bureau in their relationship to present social and economic problems of rural communities.

Organization of rural community buildings, W. C. Nason (*U. S. Dept. Agr., Farmers' Bul. 1192 (1921), pp. 42, figs. 10*).—This publication is designed to give suggestions as to the financing and control of community buildings. Articles of incorporation, constitutions, and by-laws are offered. The laws of a number of States with regard to such public buildings and directions for the organization and erection of these centers are included.

An American land policy, R. T. Ely (In *America and the New Era. New York: E. P. Dutton & Co., 1920, pp. 127–149*).—This paper is found in a symposium on problems, conditions, and policies of social reconstruction as brought about or affected by the war, edited by E. M. Friedman. The discussion brings out conditions of land ownership, tenancy, and taxation that are said to be more favorable in the United States than in other countries, as well as certain unfavorable features of tenancy and private land settlement. Widespread ownership of land, an established minimum for a farmer's holding such as will enable him to support and educate his family fairly, relatively easy attainment of land ownership, a socialized rural and urban population, and a wide distribu-

tion of the increment of land values are suggested as ideals on which to base an American land policy. Definition and classification of the lands of the United States are urged, as are also public ownership of natural resources and strategic and submarginal lands, and the establishment of State and Federal land commissions to promote and regulate tenancy and wise land settlement and to afford better credit facilities.

The drift toward the city, B. H. HIBBARD (In *America and the New Era. New York: E. P. Dutton & Co., 1920, pp. 151–165, figs. 3*).—In these pages of the volume noted above the author discusses changes in the extent of the rural population of the United States on the basis of census data, and points out certain geographic sections where marked changes have taken place. Economic conditions influencing the migration cityward are discussed, and social and educational needs in rural districts are briefly noted. It is concluded, however, that it is not yet time to deplore the farm population situation.

Land settlement, H. A. SMITH (*N. S. Wales Statis. Register, 1918–19, pt. 13, pp. 957–997*).—This report continues information previously noted (E. S. R., 43, p. 191) relating to alienation and occupation of lands in New South Wales for the year ended June 30, 1919, with summaries and comparisons for earlier years.

The agriculture of Utah, F. S. HARRIS (*Utah Sta. Circ. 44 (1921), pp. 32, figs. 19*).—Census and other available data are tabulated and illustrated on maps of the State to show the crops and live stock produced, climate, soils, and other agricultural information.

Has the Belgian Kongo a promising agricultural future? E. LEPLAE (*Rev. Gén. Agron., n. ser., 10 (1920), Nos. 1, pp. 16–26; 2, pp. 88–93; 3, pp. 114–132; 4, pp. 171–187*).—The author answers his question in the affirmative, pointing out three measures which he deems necessary for the agricultural development of this Belgian colonial possession, namely, the establishment of improved means of transportation, encouragement by the administration of colonization by Belgian farmers, and the training of agricultural laborers among the natives.

The question of agricultural labor after the war, G. FRÖLICH (*Jour. Landw., 64 (1916), No. 1–2, pp. 9–22*).—In this article, written during the war, the author holds that wherever possible there must be an extension of acreage of hand cultivated crops in Germany after the war, in spite of the fact that more intensive labor is required than in the production of grains. Such a system of agriculture would require the use of more imported labor, and since the neighboring countries formerly contributing to the labor supply would need all the workers in home fields, German agriculture must look farther eastward, even to the possible utilization of coolie labor.

In regard to the question of home colonization, it is said that many phases of this means of improving the labor conditions at home are as yet undeveloped and indefinite. It is maintained, however, that one advantage involved is that the labor of the youths between 14 and 17 years of age may be used at home in farm workers' colonies, without detriment to the young people and with advantage to the agricultural situation.

Suggestions for a national marketing program for the country's agricultural products, G. LIVINGSTON (*Econ. World, n. ser., 22 (1921), No. 1, pp. 5–7; also in Banker-Farmer, 8 (1921), No. 8, pp. 5, 6, fig. 1*).—The program suggested here includes 11 lines of work, as follows: The establishment of national standards for farm products, government inspection, complete and authentic market reporting, development of foreign markets for surplusses, improvement of methods of handling products during marketing, farmers' cooperative marketing, information as to marketing costs, equal protection of agriculture and industry by the tariff, development of a financial policy, pro-

vision of adequate transportation facilities, and regulation of potential monopolies.

Cooperative advertising, a social service as well as a powerful sales force, D. FRANCISCO (*Los Angeles, Calif. Fruit Growers' Exch.* [*1919*], *pp. 23, figs. 13*).—Arguments for cooperative advertising as a means of enlarging the basic market, lowering the cost of selling, spreading the season, commanding competitive markets, and improving the quality of a product are illustrated with statistics and graphs relating to the marketing activities of the citrus fruit industry through a period of years.

The development of prices of agricultural machinery and tools since the outbreak of the war in relation to the business organization of farms, H. SCHWANECKE (*Mitt. Deut. Landw. Gesell., 35* (*1920*), *Nos. 37, pp. 495–498; 38, pp. 509–512; 39, pp. 518–521; 40, pp. 533–537; 41, pp. 544–549; 42, pp. 558–562*).—Considerable tabulated data with discussion are given here, indicating German exports and imports of agricultural machinery of various kinds before the war, prices of materials used in their manufacture, increases in price and contributing factors, and the effect of recent high prices on the demand. It is stated that the question before the farmer is whether he can afford to pay the high prices demanded, or whether he should modify his business to avoid purchases at the present time.

Study is made of wages, agricultural labor cost, horse labor required, prices of agricultural machinery and supplies, and prices received for products for the period 1910–1913, comparing three size-groups of farms in this respect.

It is pointed out in conclusion that operating costs, taxes and insurance, wages, and expenses for machinery and seed supplies have increased at a greater rate than property values. The cooperative use of machinery is suggested as one feasible method of meeting this item of cost of operation.

Farm records and accounts, H. M. ELIOT and H. B. KILLOUGH (*Texas Sta. Bul. 264* (*1920*), *pp. 40, figs. 14*).—Four parts of this bulletin discuss inventories, records of sales and purchases, income tax returns, and records of crops and live stock produced and sold as phases of farm accounts, giving sample pages to illustrate methods recommended.

Seasonal labor requirements are discussed as a factor in farm business planning (pp. 31–38) on the basis of data presented from a slightly different point of view in a bulletin previously noted (E. S. R., 38, p. 89).

Part 5 offers a few practical rules of farm arithmetic.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3* (*1921*), *Nos. 23, pp. 353–368, figs. 2; 24, pp. 369–384, figs. 3; 25, pp. 385–400; 26, pp. 401–416, figs. 2*).—These numbers offer the usual abstracts of market information to about June 18, 1921. Special articles in No. 23 review the production and consumption of wool in 1920 in Western Europe, North America, and the Southern Hemisphere with comparisons for prewar years, and report this season's acreage of wheat in Italy as approximately the same as the average of five prewar years, while imports have returned to prewar levels.

Characteristics of the market for fruits and vegetables in Pittsburgh are noted in No. 24. No. 25 contains a report on the area of cotton planted in Egypt in 1921, notice of the further extension of the Bureau of Markets radio market news service, and a summary of emergency tariff rates on leading farm products compared with rates of 1913 tariff act.

Suggestions for a national marketing program by G. Livingston, noted on page 395 from another source, are offered in No. 26, together with a summary of 1920 apple production, prices, and movement.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7* (*1921*), *No. 6, pp. 61–72, figs. 3*).—The usual monthly estimates of acreage and condition of

important crops, summaries, brief articles, and tabulations of data as to stocks, farm value, and the prices received are given in this number.

Figures based on reports received from country banks in answer to a question as to interest rates for short-time loans to farmers are tabulated by States and grand divisions as of April, 1912, 1913, 1920, and 1921. They indicate that the Georgia average rate for 1921, 10.36 per cent, is the highest of any State average, and is about 73 per cent higher than the lowest State average, 6 per cent, reported from several North Atlantic States. It is shown, however, that the present spread in the different sections of the country is not quite so wide as formerly.

Illinois crop report (*Ill. Dept. Agr. Circ. 292 (1920), pp. 51*).—Revised statistics for 1919, together with statistics of acreage and yields, prices of important crops, and wages of farm labor for 1920 as secured cooperatively by State and Federal authorities are given here by districts and counties. Brief notes on the winter wheat and rye sown in the fall of 1920 are offered, and special tables are included which indicate the relative importance of Illinois as the third agricultural State of the Union.

[Agricultural statistics for the Netherlands] (*Jaarc. Konink. Nederlanden, Rijk Europa, 1915, pp. 213–228; 1916, pp. 193–208; 1917, pp. 200–214; 1918, pp. 202–216; 1919, pp. 206–220*).—The pages noted of these volumes continue agricultural statistics previously noted (E. S. R., 36, p. 393).

[Agricultural statistics of Sweden] (*Statis. Arsbok Sverige, 8 (1921), pp. 68–91*).—These pages add statistical summaries and comparisons for later years to the series previously noted (E. S. R., 44, p. 492).

[Land tenure and settlement and agricultural and pastoral production in Australia], G. H. Knibbs (*Off. Yearbook Aust., 13 (1901–1919), pp. 261–420, figs. 6*).—These pages continue information previously noted (E. S. R., 42, p. 894).

Agricultural and pastoral statistics, M. Fraser (*New Zeal. Gaz., Sup., 1920, pp. 3309–3347*).—Tabulated statistical data are published here, showing by counties and districts of New Zealand for the season 1919–20 the area sown to the principal crops, actual yields, total area in cultivation and in occupation, numbers of live stock, numbers of farm employees, and the number and power of the various classes of farm machinery on holdings over one acre in extent.

AGRICULTURAL EDUCATION.

Semicentennial history of the University of Illinois.—I. The movement for industrial education and the establishment of the university, 1840–1870, B. E. Powell (*Urbana, Ill.: Univ. Ill., 1918, vol. 1, pp. XXII+631, pls. 20, fig. 1*).—This volume of the semicentennial history of the University of Illinois, with an introduction by E. J. James, deals with the movement for industrial education and the establishment of the University of Illinois, 1840–1870. It includes the Illinois plan for a system of land-grant colleges, its introduction into Congress and enactment into law, and sketches of the lives of the men who led in this movement. An appendix contains documents from which much of this material was obtained.

Wisconsin, J. F. A. Pyre (*New York: Oxford Univ. Press, 1920, pp. [VII]+419, pls. 13 fig. 1*).—This is a history of the University of Wisconsin, including an account of the early settlement of the State of Wisconsin.

Massachusetts independent vocational schools in operation July 1, 1920 (*Mass. Dept. Ed. Bul., No. 7 (1920), pp. 120*).—This bulletin is a revision of that published in 1914 (E. S. R., 32, p. 288). It comprises a summary of the number of schools according to type; laws under which the schools are oper-

ated; a descriptive catalogue of all State-aided vocational schools, including, among others, 2 day industrial schools for girls, 1 evening industrial school for women, 10 day homemaking schools for girls, 29 evening practical art classes for women, 6 separate agricultural schools, 15 agricultural departments in high schools, and 11 evening or short unit course agricultural departments; courses offered; and conditions of admission.

Some of the possibilities of the rural school survey, G. W. STONE (*Wis. Teachers' Assoc. Proc., 66 (1919), pp. 201–211*).—Information on how district surveys were made and used in the schools of Dane County, Wis.

The organization of agricultural instruction in the Republic of Mexico based on the establishment of farm schools, R. ESCOBAR (*Rev. Agr. [Mex.], 5 (1920), No. 7, pp. 548–556, fig. 1*).—This is an outline of a project, together with general regulations, for the establishment of farm schools, as approved November 11, 1920, by a council of the chiefs of the General Direction of Agriculture. This is to be in force until December, 1921, when a meeting of delegates from the different farm schools that may have been established is to discuss necessary modifications.

Horticulture: Report on the State gardening school and horticultural schools for 1919 ([*Norway Landbruks Dept.*] *Landbruks Direkt. Ber. Tillaeg G, 1920, pp. G–107, figs. 20*).—This is a detailed report on the work of the gardening and horticultural schools in Norway in 1919.

Symposium of garden supervisors from coast to coast. Baltimore, Pittsburgh, Cincinnati, Louisville, St. Louis, Kansas City, Seattle (*Nature-Study Rev., 17 (1921), No. 3, pp. 103–120, figs. 3*).—This symposium comprises the following articles: Home Gardens of Baltimore, by A. Derringer; Gardening in the City School Curriculum, by J. A. Hellinger; School Ground Improvement Resumed in Cincinnati, by L. Lamarre; Extracts from the Supervisor's Report, Louisville, Ky., by E. Yunker; Functioning the School Garden with the Home Garden, by H. C. Irish; School Gardening Viewed Vocationally [in Kansas City, Mo.], by C. L. Quear; Notes from a Home Garden Supervisor [in Seattle], by H. Seaman; and Nature Gardens in New York City, by V. E. Kilpatrick.

Illinois school garden section (*Ill. State Teachers' Assoc., Jour. Proc. 66 (1919), pp. 170–181*).—This is a brief report of the meeting of the school garden section of the Illinois State Teachers' Association on December 30, 1919, including a paper on The Normal Plan, by C. F. Miller, which describes the plan of organization and work of the children's garden club at the Illinois State Normal University, Normal, Ill., organized eight years before, and which had enrolled 549 active members who tilled over 20 acres of land.

Children's gardens in a steel town, L. S. THOMAS (*Nature-Study Rev., 17 (1921), No. 3, pp. 131–141, figs. 3*).—The author describes the children's garden work instituted in 1913 by the welfare department of the U. S. Steel Corporation in the city of Duquesne, Pa.

The small agricultural fair, O. E. REMEY (*Mass. Dept. Agr. Circ. 17 (1920), pp. 23*).—This is a discussion of the organization and activities of the agricultural community fair and its mission in encouraging production, solving farm labor and marketing problems, keeping boys and girls on the farm, providing entertainment, etc.

Interesting the farmer in education, J. L. DUNBAR (*Ill. State Teachers' Assoc., Jour. Proc. 66 (1919), pp. 125–130*).—This is a statement of some of the practical things undertaken by the schools to-day to arouse the interest of the farmer by concrete applications to the various activities of farm life.

Natural history studies: An anthology from the author's own works, J. A. THOMSON (*New York: Henry Holt & Co., 1921, pp. [VIII]+244, figs. 30*).—This book consists of selections from the author's own works, arranged by seasons.

Be patriotic, vote for a national tree (*Nature-Study Rev., 17 (1921), No. 3, pp. 123–127, fig. 1*).—Descriptive notes are given on nature lessons in the study of trees in an endeavor to educate the voters in the eighth grade of the schools of Washington, D. C., in the selection of a national tree in a national campaign launched by the American Forestry Association.

Elementary home economics, M. L. MATTHEWS (*Boston: Little, Brown & Co., 1921, pp. XX+343, figs. 105*).—This book, arranged for use in the elementary schools, comprises projects in (1) sewing and textiles, involving the selection of clothing and garment making, and (2) foods, their selection, preparation, and preservation, and the planning of meals from the nutritive aspect and economic viewpoint. Lessons on the house and its care are correlated with the other work whenever possible. Laboratory exercises, home problems, and reference questions are included.

Foods and cookery and the care of the house, M. L. MATTHEWS (*Boston: Little, Brown & Co., 1921, pp. XVI+189, pl. 1, figs. 44*).—This volume, which is intended for classes beginning the study of the subject, deals with foods and their selection, food preparation, and meal planning. Preliminary lessons in cookery precede the "projects," making up the major part of the book, which, besides the three meals, breakfast, luncheon, and dinner, include food preservation, Christmas lessons, and supplementary lessons dealing with the care of the house and food for the sick. Home problems are included in order that the home and school work may be correlated.

Many illustrations and a full index add to the usefulness of the volume.

Household mechanics in the Detroit public schools, E. L. BEDELL (*Manual Training Mag., 22 (1921), No. 10, pp. 316–323*).—The author describes the one-year course in household mechanics which is replacing the manual training course in the eighth grade of the public schools in Detroit. The purpose of the course is to present a study of the structure and materials of a modern dwelling house and to teach the use and maintenance of all household appliances. A detailed outline of the course, together with lists of the necessary equipment, is given.

NOTES.

Michigan College and Station.—The State appropriation for the ensuing biennium aggregated $990,000, the largest sum in the history of the institution. This amount is equally divided between the two fiscal years, and embraces $140,000 for the cooperative agricultural extension work, $400,000 for the construction and equipment of a home economics building, and $450,000 for a library building.

Several revisions in the curriculum have been adopted, effective with the new academic year. These changes afford opportunity for a wider choice among courses, particularly by juniors and seniors. In dairying, new courses are offered in dairy barn management, market milk production, and dairy farm management. Courses are also offered in stock judging and dairy and beef cattle. Other changes involve additional work in farm mechanics and farm crops, and a general course in genetics, which is to be fundamental to all similar work in other departments.

The home economics courses have also been reorganized so that students may now take general science work with a minimum of home economics subjects; a technical course for training teachers, dietitians, extension specialists, and similar professional workers; or a general home economics course to prepare for teaching in elementary and secondary schools, social service workers, teachers in related fields, and home making. The departments of household science and household arts have been combined, the entire instruction force being designated as professors, associate or assistant professors, or instructors in home economics.

The resignations are noted of Miss Coral R. Havens as extension specialist in home economics, effective June 20; C. W. Waid as extension specialist in potatoes and vegetables, effective March 31; and Ezra Levin as research associate in soils and muck crops, effective June 30. Dr. C. H. Burgess, professor of poultry husbandry and poultry husbandman, has resigned, effective January 1, 1922, and has been granted leave of absence until that time.

Frank Davenport has been appointed assistant in bacteriology, beginning July 1.

Washington College and Station.—The first units of the new poultry plant, consisting of a colony laying house 24 by 30 ft. and a colony brooder house 12 by 24 ft., are now under construction. In addition, contracts have been let for a 2-story incubator house 38 by 60 ft., a 2-story feed house 30 by 40 ft., a breeding and laying house 16 by 196 ft., a brooder house 16 by 120 ft., and an additional colony brooder house 12 by 24 ft. The plant will be constructed in units so that it may be added to as the future may require. It will be used as a laboratory for instruction in poultry, both for vocational and college students, and for experimental work in breeding and poultry production.

It is expected that the buildings will be completed at the opening of the college year.

EXPERIMENT STATION RECORD.

VOL. 45. OCTOBER, 1921. No. 5.

Funds for the support of agricultural education and research in this country continue to be almost wholly of public origin. This is not surprising in view of the elaborate system of institutions built up by the Federal and State Governments. None the less a considerable number of individuals have from time to time evidenced their interest and belief in these activities by private contributions.

About ten years ago an attempt was made in these columns [1] to assemble data regarding these contributions, and numerous instances were mentioned of appreciable and timely assistance which had been afforded by private aid. It was brought out, for example, that several substantial bequests considerably antedated the passage of the original Morrill Act of 1863. The contribution of relatively small sums of money by Mr. Orange Judd in Connecticut in 1873 and Prof. Levi Stockbridge in Massachusetts in 1878 was also cited as largely instrumental in initiating experimental work in these States and thereby paving the way to a comprehensive national experiment station system.

The last decade has not brought many gifts of outstanding importance, but the record is by no means barren. In the field of collegiate instruction, perhaps the largest in amount has been a $1,000,000 fund received in 1916 by the Delaware College for general purposes from a donor whose name has been withheld. This gift has enabled the institution to erect several new buildings and increase its endowment funds, thereby greatly improving the facilities for agricultural instruction as well as other phases of its work.

A grant of $250,000 by the General Education Board was made in 1912 to the George Peabody College for Teachers at Nashville, Tenn., to establish the Seaman A. Knapp School of Country Life. This gift was contingent on the raising of an equal sum by the institution, and led to the development of this school, which now offers courses in agriculture, rural education, rural economics, home economics, and related sciences and arts, and operates what is known as the Knapp Demonstration Farm.

A notable bequest, estimated at about $4,000,000 in value, was announced in 1920 following the death of Mr. Ohio C. Barber. The

[1] E. S. R., 25, p. 401.

bulk of his estate was left to five trustees with instructions to found the Ohio C. Barber Agricultural and Industrial School on his two-thousand acre farm at Barberton, Ohio. The will provided for "education along agricultural and industrial lines and all things pertaining thereto, for the benefit of men and women of this and of succeeding generations to aid them in becoming industrious and useful citizens, and especially looking to the development of proper treatment of soil as well as to the development of manufacturing industries connected and affiliated therewith."

The transfer to the State of Vermont of the agricultural school at Lyndon, with land and equipment valued at $150,000, was effected by its founder, Mr. Theodore N. Vail, in 1914. In 1917 a farm of 130 acres at Newington, Conn., on which about $50,000 had been expended for improvements, was tendered the Connecticut College for school purposes by Mr. Austin C. Dunham.

Two gifts to local communities for agricultural work have been reported. One of these was an elaborate farmers' club house, dedicated in 1914 at Seymour, Ind., as a memorial to Capt. Meedy W. Shields, founder of the town and donor of the funds utilized in erecting the building. The second was a bequest by Mr. Clinton C. Haynes of an estate of $20,000 in the town of Wilmington, Vt., "for the benefit of agriculture in said town." The investment of the fund was required, the income being annually applied for lectures, experiments, and other purposes tending to promote the agricultural interests of the community.

Private contributions for experimental purposes have not infrequently taken the form of gifts of land. Thus, Purdue University has received three important gifts of this sort. The first of these was the so-called Moses Fell Annex, comprising two tracts of 360 and 120 acres each at Bedford in southern Indiana, and donated by Hon. Moses F. Dunn in 1914. One of these tracts contained extensive limestone quarries yielding considerable revenue. The chief restrictions imposed by the bequest were its utilization primarily for experimental and demonstration purposes, and work along these lines in horticulture, animal husbandry, and soil and crop improvement has been in progress for several years.

The second tract was given the university in 1919 by Mr. William E. Pinney and his daughter, Mrs. Myra P. F. Clark, as a means of "permanent service to the agriculture and country life of northern Indiana." This tract consisted of two parcels, the Pinney-Purdue Farm and the Pinney-Purdue Soil Experimental Field, of 400 and 67 acres, respectively, and is being used to study various agricultural problems of the region.

The third tract consists of 385 acres of virgin forest land in Randolph County, and does not become available until December 1, 1921.

This property, given by Mrs. Henry Davis and known as the Henry Davis Forestry Farm, is required to be maintained as a forest preserve and refuge for wild life. Commercial cuttings are not permitted, but it is expected to carry on experiments in the acclimatization of useful plants.

In 1917 the West Virginia Station received a bequest from Mr. Lawrence A. Reymann of an estate of over 900 acres of improved land, well equipped with buildings and with 125 head of purebred Ayrshire cattle, the entire plant being valued at about $120,000. The purpose of the gift as stated is to promote, develop, and advance the science of agriculture in its most comprehensive scope, and in addition to give special attention to the breeding and development of Ayrshire cattle.

In several other States individuals or communities have provided land for the experiment station to enable it to carry out local or special experiments. For instance, a tract of over thirty acres in Hardin County was given the University of Illinois in 1917, this making the twenty-sixth tract to be given it for agricultural work. In 1919 a tract of five farms in Maine, aggregating over a thousand acres, was donated by Mr. P. W. Sprague of Boston to the Maine Agricultural and Industrial League, primarily for demonstration purposes. Within the last year two tracts have been conveyed to Cornell University by individual gifts for a fresh-water biological field station and a wild-life preserve for research and study.

Land for the citrus substation at Lake Aldred, Fla., was donated in 1919 by citrus growers of Polk County, together with funds for the erection of a building and the maintenance of the substation. A study by the Florida Station of pineapple diseases was also made possible about the same date by funds placed at its disposal by growers of St. Lucie County.

During the past summer considerable work in tobacco improvement was instituted by the Connecticut State Station. A tract of thirteen acres was acquired from funds accruing under the Lockwood bequest of 1894, and cooperation with the newly organized Connecticut Valley Tobacco Improvement Association has been possible through funds supplied by this association of growers, packers, and dealers supplementing a State appropriation of $10,000.

An interesting experiment which would not have been possible with funds available from other than private sources has recently been begun in Indiana. An exhibit made at the Indiana State Fair and later at the International Live Stock Show at Chicago, showing models of a specific farm in run-down condition and rehabilitated on a scientific plan, attracted the attention of two gentlemen who offered to purchase the farm in question and finance its renovation.

The farm was purchased the past spring, new buildings erected and others repaired, and a definite farm system laid out. The purchase price and improvements will represent a total expenditure of from $100 to $120 an acre. A local committee, consisting of the president and vice-president of the local farm bureau, the county agent, and a merchant, is operating the farm, with the advice of specialists at Purdue University, through a working foreman. Local initiative is thus stimulated and is practically in charge of the enterprise, which, if successful, will benefit not only the community but other sections. Everything will be conducted on a practical basis and strict accounts kept, and incidentally the university and station expect to get some quite accurate data.

The University of Tennessee has been the recipient of two interesting bequests. One was the Strong legacy of 1915, compromised after considerable litigation to include $65,000 and certain real estate, about $35,000 becoming available for the College of Agriculture. The other was a gift of $25,000 from Miss Mary Boyce Temple in 1919 for the carrying on of certain agricultural tests by the division of agricultural extension.

An income of about $2,000 a year became available to the University of California in 1920 through the will of Mr. James Horgan for the promotion and development of agriculture, especially at the University Farm at Davis. In 1915 the Washington Station was given $1,000 by Mr. William Anderson for studies of diseases of domestic animals.

The Biggs Cereal Station was organized by the Sacramento Valley Grain Association, Inc., of California on a subscription basis to develop new and more profitable crops for the valley, and a tract of about fifty acres of land and buildings costing $6,000 were provided. In 1912 this plant was turned over to the Bureau of Plant Industry, U. S. Department of Agriculture, for operation as a field station in connection with its cereal investigations and devoted quite largely to rice experiments. Somewhat similarly, the plant of the Virginia Truck Station at Norfolk was donated in 1917 to the State by the local truckers' association which had organized it. A fig experiment station under the auspices of the J. C. Forkner Fig Gardens began operation near Fresno, Calif., in 1920, about ten acres being available for experimental purposes.

Two noteworthy projects of the past year have been the founding of the Thompson Institution for Plant Research at Yonkers, N. Y., and the American Food Research Institute at Leland Stanford University. For the latter institution, a grant of $700,000 has been made by the Carnegie Corporation of New York for maintenance for the first ten years, and an intensive study of problems connected with the production, distribution, and the consumption of food is contemplated.

Even more recent has been the establishment of the Marble Laboratory, Inc., at Canton, Pa., from funds provided by Mr. L. M. Marble for study of problems connected with fruit storage. Equipment has been provided for ventilation and humidity studies, including cold storage rooms, and a sixty-acre apple orchard is available to supply material.

Despite efforts to obtain as complete a record as possible, numerous contributions have doubtless been omitted from the foregoing summary. Opportunity has recently been afforded, however, to obtain another view of the situation as regards research through a compilation issued by the National Research Council. This compilation deals with funds available in 1920 in the United States for the encouragement of scientific research, and is classified both by institutions and subject matter.

It is interesting and at first sight somewhat disheartening to note that of nearly a thousand separate funds itemized, the number classified under agriculture consists of only two funds for institutional research and ten series of fellowships, scholarships, research assistants, and similar positions. More extended examination of the system of classification, however, reveals the inclusion of numerous other funds of direct agricultural interest under the basic sciences, such as bacteriology, biology, chemistry, ecology, genetics, and veterinary medicine, as well as an even larger number classified as industrial research.

The two funds listed as available under agriculture are the Bradley fund of $20,000 established in 1897 at Harvard University for scientific investigations to increase the knowledge of trees, and the Ring memorial fund of $1,000 at Cornell University for the advancement of horticultural science. The fellowships and scholarships provide for a considerable range of subjects, including inheritance of disease resistance, economic entomology, and forest production at the University of Wisconsin; agricultural history and general agriculture at the Iowa State College; agronomy, animal husbandry, dairy husbandry, poultry husbandry, food economics and nutrition, bacteriology, and botany at the Kansas College; agriculture and botany at the Washington College; agriculture at the Universities of California and Minnesota; and seven industrial phases of agriculture at Cornell University. There is also included a travel fellowship of $1,000, established by the American-Scandinavian Foundation for the purpose of drawing the American and Scandinavian peoples closer in bonds of intellectual friendship.

Of the funds classified under industrial research, mention should be made of $2,200 annually available for investigations at the University of California of citrus fruits from the Citrus Fruit Growers'

Fund; $2,880 for lemon investigations from the Lemon Men's Club Fund; and $2,000 for poultry studies from the Petaluma Poultry Men's Fund. The same university also had available $15,800 and Leland Stanford University $12,600 for investigations of botulism, these funds being provided by olive growers and commercial interests. A considerable range of industrial fellowships and scholarships is also listed, including eleven at Rutgers College on various plant nutrition problems and disinfectants, six at various institutions for studies of the use of gypsum in crop production, one at the University of Hawaii for the study of pineapple problems, and one each at the Kansas College and Leland Stanford University in flour milling problems.

The compilation of the National Research Council also attempted to list the medals and prizes available. None of these were discovered for agricultural research, and of those under other heads only one seems directly applicable. This is the Meyer Memorial Medal for distinctive service in plant introduction, established in 1919 from funds left by the late Frank N. Meyer, agricultural explorer of the U. S. Department of Agriculture for many years.

From a study of the data available, the conclusion appears inevitable that agricultural education and research are still being comparatively overlooked as opportunities for private philanthropy. During the past decade financial assistance for specific problems has been provided in increasing amounts in some States by groups of producers and commercial organizations, but the possibilities in even these directions have by no means been exhausted.

Likewise, the alumni associations of various agricultural colleges have greatly improved in solidarity and effectiveness, and more and more have contributed financially as well as in other ways to the up-building of their respective institutions. The elaborate soldier memorials, quite commonly in the form of student activities' buildings, already completed in Massachusetts and under way in Ontario, Michigan, Iowa, California, and other States, may be cited as concrete illustrations of the growing realization of alumni responsibility, as well as an indication of their disbelief in the fear sometimes expressed that private contributions may merely serve to substitute these funds for public appropriations.

But the aggregate of all such gifts is still small, too small with most institutions to make them appreciable factors in the institution's budget. It is even probable that the total thus contributed for agricultural education and research in this country is considerably less than the amount raised within our borders for the support of agricultural missions abroad, these enterprises now numbering, it is reported, farms at no fewer than 241 mission stations. Quite cer-

tainly it is smaller than the private support accorded in Great Britain for agricultural instruction and research, where, however, public aid has been comparatively recent and less exclusively relied upon.

In the field of research, the opportunities seem specially numerous at the present time, whether for large or more modest contributions. Inadequate revenues, both absolutely and relatively, have since the war become more and more a limiting factor in the progress of agricultural research agencies. It may again be pointed out that the world still lacks a large and permanently endowed institution for research in agriculture, analogous to the Rockefeller Institute in the field of medical science, for example, though the usefulness of such an institution was never more apparent. On a smaller scale, the provision of funds for fundamental studies requiring a considerable period for solution would appreciably relieve the pressure on tax-supported institutions for immediately practical results, and correspondingly augment their resources and usefulness.

Doubtless one of the principal reasons for the paucity of private contributions in the past has been the unfamiliarity as to the real needs of educational and research institutions of persons in position to aid. Oftentimes this is a condition which might readily be remedied to some extent by the institutions themselves through greater publicity. Obviously, no campaign of solicitation of the wealthy could properly be undertaken, but there would seem to be ample justification for letting the public know the situation and some of the ways in which private funds applied to agricultural education and research could render effective returns. In this way the cooperation of benevolent persons or organizations with institutions designed for the benefit of the general public might be stimulated.

The recent announcement by the United States Department of Agriculture of the initiation of graduate courses of instruction for its personnel is an important departure which may mean much to those availing themselves of the opportunity. It is at once a recognition of the desirability of systematic study for those specializing closely in their work, and a response to the desire for such instruction by employees whose duties confine them closely to Washington. It is an attempt to utilize available material in stimulating broader training.

For many years the lack of facilities in the District of Columbia for advanced study in agricultural lines has been a serious handicap to the Department's efficiency as a growing scientific institution. Of the hundreds of ambitious young men and women attracted to its ranks by its unique position for service along national lines, far

too many have become discouraged in their efforts to broaden or extend their training and have accepted positions elsewhere with greater opportunities for study, while with others the restriction of their individual development has reacted to the disadvantage of the Department as a whole. What has made the situation the more regrettable has been the presence on the Department's own staff of many authorities in various fields of agricultural science competent to offer such instruction, the unusual wealth of original data, the unexcelled library facilities, and other educational assets of great potentiality.

In recent years efforts have been made to utilize some of these advantages, and under Department and bureau auspices lectures by the Department's own staff and visiting scientists have become quite numerous and a source of much inspiration and enlightenment. The almost total lack of suitable quarters for even relatively small groups, however, has been a very definite handicap to gatherings of this sort, and the information obtainable has necessarily been too fragmentary and sporadic to constitute in any sense a substitute for formal graduate instruction. Manifestly it could not be accepted as a basis of credit by educational institutions, a phase in which Department workers have been acutely interested.

In recognition of these things, during the past summer representatives of the various scientific bureaus were designated as a committee under the leadership of Dr. E. D. Ball, then Assistant Secretary of the Department, to consider the problem of arranging, if possible, a program of educational work for the current year. Such a program was eventually formulated and approved by Secretary Wallace for immediate adoption.

This program contemplates an unofficial system of advanced instruction in those scientific and technical subjects relating to the Department's work in which adequate instruction is not otherwise available in Washington. This restriction is intended to prevent duplication of the opportunities already open in some of the sciences and related fields through the various educational institutions of the community, and the courses will thus supplement existing facilities and resources.

The object of the instruction is stated in the prospectus as "to enlarge and improve the service rendered by the Department by affording an opportunity to those who wish to fit themselves for greater usefulness through better training and increased knowledge." For the present, two more or less distinct kinds of work will be offered. The first of these will include lecture and drill courses on certain fundamental subjects in which the personnel of two or more bureaus are interested. The second will comprise intensive graduate training in special topics. Lecture courses are to be held immedi-

ately after office hours. In general each course will occupy two hourly periods per week for a year of thirty weeks or a half year of fifteen weeks. The cost of the instruction will be met through very moderate tuition charges, and participation is put on an entirely voluntary basis.

The advanced courses are to be of distinctly university grade and restricted to students of adequate preparation. A system of credits will be put into operation, and it is hoped that arrangements will be completed with educational institutions for their acceptance in degree work, including both undergraduate and postgraduate degrees. If this can be accomplished, one of the principal obstacles to organized instruction in the past will have been eliminated.

For the present, attention is to be concentrated on a comparatively few lines of outstanding interest. The courses already arranged for include advanced work in agricultural economics, biochemistry, mycology, plant physiology, genetics, and the physics of the air. Two statistical courses are also scheduled, one a review course in the underlying principles, development, and application of statistical methods, and the other a detailed presentation of statistical mechanics applied to chemical problems. Most of these courses are regarded as foundations for more specialized work to follow. Ultimately, numerous special graduate courses are contemplated in various lines, embracing work to extend over several years. These courses will be carried on through the immediate supervision of Department specialists, under the general direction of the graduate committee.

Responsibility for the project as a whole will also rest largely with this committee, with Dr. Ball continuing as its head in his new position of Director of Scientific Work. While designed with particular reference to Department employees, it has been a matter of conference with the officers of the Association of Land Grant Colleges, who have expressed interest in it as opening to their students and workers another channel for advanced study.

The beginning of actual instruction was scheduled for October 17, and at the time of writing registration was in full swing with indications of a large enrollment and much interest. As time goes on difficulties of various kinds will doubtless arise, but it would seem that the new enterprise was being launched under auspicious circumstances and with exceptional opportunities for useful service. The modest scale on which it is being started indicates a conservativeness of policy which augurs well for the gradual development of a very valuable agency for graduate instruction in agricultural science.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chemist's calendar, I, II, W. Roth (*Chemiker-Kalender. Berlin: Julius Springer, 1921, vols. 1, pp. XIX+502, figs. 10; 2, pp. IX–520, pl. 1, figs. 33*).—In the 1921 edition of this well-known annual several of the sections have been rewritten and brought up to date.

Yearbook for agricultural chemistry, edited by T. Dietrich and F. Mach (*Jahresbr. Agr. Chem., 3. ser., 18 (1915), pp. XXXI+504*).—This is the yearbook for 1915 of the series previously noted (E. S. R., 35, p. 311).

Yearbook for agricultural chemistry, edited by F. Mach (*Jahresber. Agr. Chem. 3. ser., 19 (1916), pp. XXXVI+520, p. 1; 20 (1917), pp. XXX+514; 4. ser., 1 (1918), pp. XXX+546*).—These volumes continue the series noted above.

A dictionary of chemical solubilities, inorganic, A. M. Comey and D. A. Hahn (*New York: Macmillan Co., 1921, 2. ed., rev. and enl., pp. XIX+1141*).—In the revision of this very complete dictionary of inorganic chemical solubilities, the first edition of which appeared in 1895, the data have been brought up to January 1, 1916. The arrangement of data on each substance consists of the solubility in water, the specific gravity and boiling point of the aqueous solution, and the solubility in inorganic acids, in alkali and salt solutions, and in organic solvents. Where different results have been obtained by various workers, data from all the original sources are given. An appendix contains formulas and tables for the conversion of the degrees in the various hydrometer scales into specific gravity and a synchronistic table of the more important chemical periodicals from 1800 to 1916.

Technical handbook of oils, fats, and waxes, P. J. Fryer and F. E. Weston (*Cambridge, England: Univ. Press, 1920, vol. 1, 3. ed., pp. XII+280, pls. 42, figs. 33*).—This is the third revision of the volume previously noted (E. S. R., 40, p. 804).

Chemical examination of Aconitum columbianum (*Wyoming Sta. Rpt. 1920, p. 131*).—Preliminary work on the chemical examination of *A. columbianum* by P. T. Miller is briefly reported. The plant has been shown to contain both a crystalline and an amorphous alkaloid, both being found principally in the roots of the plant. A considerable yield of aconitic acid was obtained from all parts of the plant.

[Gossypol in cottonseed meal], W. A. Withers (*North Carolina Sta. Rpt. 1920, pp. 32, 33*).—Further work on the effect of various agents on the gossypol content of cottonseed meal (E. S. R., 43, p. 411) is noted, the results of which suggest the possibility that hydrolysis rather than oxidation is effective in eliminating the gossypol from the meal. The optimum conditions for hydrolysis have not been ascertained.

The effect of alkali on the efficiency of the water-soluble vitamin B, T. B. Osborne and C. S. Leavenworth (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 423–426, figs. 2*).—Attention is called to the conflicting views regarding the stability of vitamin B to alkali, and experiments are reported which confirm

the observations of those who have reported the destruction of this vitamin when heated with alkalis.

A vitamin preparation obtained from brewery yeast according to the method of Osborne and Wakeman (E. S. R., 42, p. 314) was treated with sufficient NaOH solution to neutralize the acidity of the preparation and leave an excess equivalent to N/10 alkali. Portions of this solution were allowed to stand at 20° C. for ½ hour, 18 hours, and 90 hours, respectively, and were then made faintly acid to litmus with N/10 HCl. A fourth portion, after standing at 20° for 18 hours, was heated to 90° in a water bath for 1 hour and then slightly acidified. The extracts were all evaporated on starch and made into tablets, each containing 15 mg. of the vitamin extract. These were administered to rats declining on a diet free from vitamin B.

The subsequent growth curves of the animals showed that the efficiency of the vitamin was not appreciably impaired by the ½ or 18-hour treatment with alkali, but that more prolonged treatment impaired and heating quickly destroyed the activity. "It thus appears that in attempting to concentrate, or isolate, the water-soluble vitamin B dilute alkaline solutions can be used without materially affecting its activity, provided a low temperature and a short time of exposure to the alkali are employed."

The significance of the H-ion concentration for the digestion of proteins by pepsin, J. H. Northrop (*Jour. Gen. Physiol., 3 (1920), No. 2, pp. 211–227, figs. 4*).—In this paper, which continues the series of studies on pepsin previously noted (E. S. R., 44, p. 110), experiments are reported which show that the rate of digestion and the conductivity of protein solutions are very closely parallel, that when proteins of different isoelectric points are used the range of H-ion concentration in which the enzym is active shifts in the same sense as the conductivity of the protein solution, and that the enzym combines with an insoluble protein only over that range of H-ion concentration in which the enzym is active and the protein ionized. It is pointed out that while these facts are in agreement with the hypothesis that the determining factor in the digestion of proteins by pepsin is the amount of ionized protein present in the solution, this hypothesis "can not be extended directly to enzyms in general, since in many cases the substrate is not known to exist in an ionized condition at all. It is possible, however, that ionization is really present, or that the equilibrium instead of being ionic is between two tautomeric forms of the substrate, only one of which is attacked by the enzym."

Colorimetric determination of H-ion concentration by means of a double-wedge comparator, G. D. and C. W. Barnett (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 4, pp. 127–131*).—The method described by Barnett and Chapman (E. S. R., 39, p. 9) for determining H-ion concentration colorimetrically without the use of buffer solutions has been extended to the group of indicators of Clark and Lubs, the work reported being largely a confirmation of the results of Gillespie (E. S. R., 43, p. 11) which appeared while the present investigation was in progress.

For making the determination reported, a comparator was used which consisted of a long narrow rectangular glass box containing a diagonal glass partition, dividing it into two equal wedge-shaped compartments placed base to apex. With one wedge filled with acid indicator solution and the other with alkaline indicator solution of the same concentration, light transmitted horizontally through the box gives the complete color range of the indicator.

"For calibrating the color scale in terms of pH, buffer solutions of known H-ion concentration and containing the same indicator concentration were placed in a small glass box having the same fluid diameter as the large box.

For any given buffer solution within the range of the indicator an exact color match is obtained. A scale along the lower edge of the comparator is divided into 100 parts and graduated from left to right. If the acid color of the indicator occupies the left end of the comparator, the readings of this scale will thus represent the percentage of alkaline indicator color present in the color blend observed at that point. The colors are best viewed against an oblique plate mirror reflecting the sky."

A table of dissociation constants of the indicators used and the corresponding scale readings is included.

A new nephelometer and the principles of nephelometric measurement, H. KLEINMANN (*Kolloid Ztschr., 27 (1920), No. 5, pp. 236–241, figs. 3; abs. in Jour. Soc. Chem. Indus., 40 (1921), No. 3, pp. 101A, 102A*).—The principle of the new type of nephelometer described is the measurement of the height of a Tyndall cone which produces the same intensity of illumination in two liquids, one of which is the standard. Two graduated glass tubes, in each of which is a polished glass cylinder, are placed side by side on a metal foundation in front of two adjustable shutters. The unknown and standard liquids are placed in the tubes, and the width of the shutter openings so regulated that the light passing through them from the Tyndall cones illuminates both with equal intensity.

A short test for easily soluble phosphate in soils, O. M. SHEDD (*Soil Sci., 11 (1921), No. 2, pp. 111–122*).—A rapid test which has been devised at the Kentucky Experiment Station for estimating roughly the soluble phosphorus in soils is described, and comparisons are reported of results obtained by this short test with the quantitative results from 5-hour digestion with the same reagents. The technique of the short test is as follows:

Ten gm. of air-dried soil is added to 25 cc. of N/50 HNO_3 and the mixture shaken every minute for 5 minutes. The solution is filtered until clear into a ¾ by 6 in. test tube, 1 or 2 cc. of 60 per cent NH_4NO_3 solution and 5 cc. of ordinary molybdate solution as prescribed in the Official method for fertilizers are added, and the contents of the tube are heated to about 60° C., shaken several times, and allowed to stand about 30 minutes at room temperature. The content of soluble phosphorus is estimated as large, moderate, etc., from the amount of precipitate formed, the term moderate indicating that the precipitate after settling occupies an area from 0.5 to about 0.75 cm. in diameter.

The quantitative determination consists in digesting the soil in N/50 HNO_3 in the proportion of 1 gm. of soil to 10 cc. of the acid for 5 hours at room temperature, shaking every 30 minutes. It is then filtered, an aliquot evaporated to dryness, more HNO_3 added to oxidize the organic matter, evaporated again, and the last traces of HNO_3 removed by evaporation with HCl. The residue is dried on a steam bath to dehydrate SiO_2, taken up with HCl and water, and filtered. The phosphorus is precipitated with ammonium molybdate and, after standing over night, filtered and determined volumetrically.

Tables are given of the results obtained in the short test and the quantitative test for soluble phosphorus, and for total phosphorus by the magnesium nitrate method in four groups of soils, classified according to the proportions of soluble and total phosphorus. The conclusions reached by the N/50 HNO_3 digestion and the short method are shown to be in accord with experimental field results as regards the soil need of phosphorus. "The weak acid digestion apparently discriminates between those soils in which the phosphorus exists as calcium phosphate and those where it is combined in other forms, such as iron and aluminum and generally considered as not available."

The separation and detection of arsenate and arsenite, G. W. SEARS (*Jour. Amer. Chem. Soc., 43 (1921), No. 3, pp. 466–470*).—A procedure for the

separation and detection of arsenate and arsenite is described which is based upon the relative solubility of their silver salts in sodium hydroxid, the arsenate being soluble and the arsenite insoluble in 0.5 to 1.5 N solutions of NaOH. The method is said to be capable of detecting 1 mg. of either ion in the presence of 450 mg. of the other.

The estimation of theobromin in cocoa and its products, R. V. WADSWORTH (*Analyst, 46 (1921), No. 539, pp. 32–37*).—The principal methods in use for estimating theobromin in cocoa and its products are reviewed and criticized, and a new method is described which is thought to combine the advantages and overcome the drawbacks of the wet and dry extraction methods.

The technique consists in thoroughly mixing 10 gm. of the substance with from 2 to 3 gm. of freshly calcined magnesia in a small porcelain dish, triturating with 14 cc. of water until every particle of the sample is moistened, and placing the dish on the water bath for half an hour to dry partially. The material is then well mixed and transferred to a 250 cc. flask, 150 cc. of tetrachlorethane is added, and the whole boiled under a reflux condenser for 30 minutes. It is filtered while almost boiling into a second flask, the residue and filter paper transferred to the first flask, and the extraction with tetrachlorethane repeated three times. The combined filtrates are distilled through an air condenser until the volume is reduced to from 3 to 5 cc. The residue is cooled, from 60 to 70 cc. of methyl ether added, and the whole mixed and allowed to stand over night, after which the precipitate is collected on tared filter paper, washed with ether, dried at 100° C., and weighed. To this weight is added 0.004 gm. as a correction for the amount of theobromin dissolved in the ether.

The detection of ricin in feeding stuffs by means of serological methods (precipitation, complement deviation, and conglutination) as well as hemagglutination, W. PFEILER and F. ENGELHARDT (*Landw. Jahrb., 53 (1919), No. 2, pp. 561–583*).—Results are reported of a series of studies of the delicacy and specificity of various serological tests for the presence of castor bean meal in feeding stuffs. The antiricin serum was obtained by immunizing rabbits with increasing doses of ricin.

Precipitation tests with this serum gave positive results with 0.001 gm. of ricin and with feeding stuffs containing 5 per cent and in some cases only 1 per cent of castor bean meal. Control tests with abrin and crotin gave negative results, indicating the specificity of the reaction for ricin. Hemagglutination tests were positive in the presence of 0.0005 gm. of ricin, but were not specific as the reaction was also given with bean meal. The complement deviation test gave positive results with ricin 1:200,000, 0.001 gm. of castor beans, or feeding stuffs containing 0.5 per cent of castor bean. The test was strongly specific. The conglutination test gave positive results with ricin 1:200,000, 0.0002 gm. of castor bean, and feeding stuffs containing from 0.5 to 5 per cent of castor bean. This test, however, proved nonspecific, bean meal also giving positive results.

The authors conclude that for forensic purposes the precipitation and deviation tests are the most reliable, and that the precipitation method has the advantage of being simpler of execution.

Volumetric determination of mixtures of sugars, T. VON FELLENBERG (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 11 (1920), No. 4, pp. 129–153*).—The method described, when used for the determination of a single sugar, is conducted as follows: Twenty cc. of a 5 per cent solution of copper sulphate, 20 cc. of a solution containing 175 gm. of Rochelle salts, 25 gm. of Na_2CO_3, and 15 gm. of NaOH per liter, and 20 cc. of water are heated to boiling in an Erlenmeyer flask. Twenty cc. of the neutral sugar solution is then added, the mixture boiled over a low flame for 5 minutes, and cooled rapidly. The

precipitated cuprous oxid is dissolved by shaking with from 20 to 25 cc. of an acidified sodium chlorid solution prepared by mixing 1 liter of saturated salt solution with 250 cc. of 10 per cent HCl. The excess HCl is neutralized by carefully adding solid sodium bicarbonate, after which the reduced copper is determined iodometrically. A blank test should be run with water. Tables are given for glucose, invert sugar, lactose, and maltose in terms of the N/10 iodin solution.

In the presence of two or more sugars the above determination is made after "strong" or "weak" inversion, and finally after direct destruction of the reducing sugars with NaOH. For the so-called weak inversion 50 cc. of the sugar solution is heated with 1 cc. of N HCl for 30 minutes on a boiling water bath, cooled, neutralized with 1 cc. of N NaOH, made up to a volume of 100 cc., and the procedure continued as above. For strong inversion 50 cc. of the solution is heated with 25 cc. of 3 N HCl for 45 minutes on the boiling water bath, cooled, neutralized exactly in the presence of methyl orange with 4 N NaOH, made up to 100 cc., and the procedure continued as above. In the presence of two sugars the method of weak inversion is used if one of the sugars is sucrose, and strong inversion if both are reducing sugars. If three sugars are present both methods of inversion are used, and as a control the direct destruction of the reducing sugars by NaOH. The determinations should be made with solutions of the same concentration of such strength that not more than 60 cc. of iodin solution is required.

The application of the method is illustrated by analyses of several infant foods and malt preparations.

A method for the determination of chlorin in solid tissues, R. D. Bell and E. A. Doisy (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 427–435, figs. 2*).—A method of determining chlorin in small amounts of tissue involving less than 5 mg. of chlorin is described, in which the organic matter is removed by a modification of the wet ashing process of Neumann. The material is ashed with concentrated H_2SO_4 and persulphuric acid, and the gases are absorbed in an alkaline sulphite solution formed by action of SO_2 from the digestion gases on sodium carbonate in the absorption tube. The solutions used for titration are those described by Van Slyke and Donleavy (E. S. R., 40, p. 714), except that the picric acid is omitted from the silver solution.

A special apparatus employing suction rather than the pressure of the boiling digestion mixture to carry the gases through the absorption tubes is described and illustrated. Results are reported of duplicate determinations of sodium chlorid in human rectal muscle in normal and pathological conditions, and of comparative determinations of the sodium chlorid content of blood and plasma by this method and the modification of the original McLean-Van Slyke method by Foster (E. S. R., 37, p. 804).

The determination of chlorids in trichloracetic acid filtrates from whole blood and plasma, M. Smith (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 437–447*).—In this modification of the original McLean-Van Slyke method for determining chlorids in blood, trichloracetic acid is used as the blood protein precipitant. The titration with starch iodid solution is rendered more sensitive by the addition of phosphoric acid to the citrate buffer solution, by the use of soluble starch freshly prepared from cornstarch, and by the addition of a definite excess of KI, the amount of which should be determined for each new buffer solution.

A system of blood analysis.—II, Simplified method for the determination of chlorids in blood or plasma, J. C. Whitehorn (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 449–460*).—This paper describes a method of determining chlorids in blood or blood plasma which is especially adapted to the system of

blood analysis of Folin and Wu (E. S. R., 42, p. 712). The procedure, which employs the tungstic acid protein-free filtrate, is based upon the principle of the Volhard method, consisting of the precipitation of silver chlorid from a known amount of silver nitrate and the titration of the excess silver nitrate by thiocyanate, using ferric ammonium alum as an indicator. The technique is described in detail, a similar procedure described by Rieger (E. S. R., 44, p. 506) is discussed and criticized, and the accuracy of the present method is discussed with experimental data indicating a limit of error of less than 1.5 per cent.

The determination of chlorids in blood plasma, J. H. Austin and D. D. Van Slyke (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 461–463*).—As the method for the determination of chlorids in blood plasma involving a single precipitation of proteins and chlorin, described by Van Slyke and Donleavy (E. S. R., 40, p. 714), has been found to give too high results with pathological cases, the authors recommend the preliminary removal of the proteins as in the Austin-Van Slyke method for whole blood before the chlorids are precipitated with standard silver nitrate in all plasmas, both normal and pathological.

A clinical method for the quantitative determination of calcium and magnesium in small amounts of serum or plasma, B. Kramer and F. F. Tisdall (*Bul. Johns Hopkins Hosp., 32 (1921), No. 360, pp. 44–48*).—A rapid method of precipitating calcium and magnesium quantitatively from small amounts of unashed blood serum by a modified McCrudden technique (E. S. R., 23, p. 9) is described, together with the technique for the separation and determination of the calcium and magnesium.

The removal of ammonia from urine preparatory to the determination of urea, G. E. Youngburg (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 391–394*).—The author states that in the Van Slyke and Cullen technique for the determination of urea by urease (E. S. R., 33, p. 116) the ammonia determination can be eliminated by preliminary removal of ammonia by the permutit method of Folin and Bell (E. S. R., 37, p. 311), and that the more satisfactory and less expensive urease solution of Folin and Youngburg (E. S. R., 41, p. 13) may be used instead of the acetone-insoluble preparation of Van Slyke and Cullen. The technique of the revised procedure is described, and data are presented showing the degree of accuracy obtainable.

An improved apparatus for use in Folin and Wu's method for the estimation of urea in blood, T. Watson and H. L. White (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 465, 466, fig. 1*).—The apparatus, which was devised to prevent frothing when distilling over the ammonia in the Folin-Wu method of determining urea in blood, is made from a 25 cc. pipette with a bulb in the center. The pipette is bent so that one end extends vertically into the distilling flask and the other, parallel to the first, into the receiving flask, the part containing the bulb forming an angle of 45° with the tube extending into the distilling flask. This part of the tube has a number of small holes blown in the side and a constriction in the end. The large bubbles of form are broken up in passing through the numerous holes, thus preventing the liquid from being carried over into the receiving flask.

Dehydrating foods, A. L. Andrea (*Boston: Cornhill Co., 1920, pp. [VI]+206, pls. 13*).—This book on dehydration contains, in addition to a brief discussion of the uses of dehydrated products and of large scale methods of dehydration, general and special directions for dehydrating foods in the home and recipes for the use of dehydrated products.

Methods of preparing vegetables for dehydration, P. F. Nichols and C. R. Gross (*Chem. Age [New York], 29 (1921), No. 4, pp. 139–141, figs. 2*).—An investigation, conducted at the Bureau of Chemistry, U. S. Department of Agri-

culture, on the relative values of different methods of blanching or processing vegetables in preparation for dehydration, is reported briefly. Freshly prepared carrots, potatoes, and cabbage were subjected to treatment with steam, hot water, hot 2 per cent salt solution, and hot 1 per cent sodium bicarbonate solution, and in the case of potatoes hot 0.1 per cent solution of sodium bisulphite or sulphite for 2, 3, and 4-minute periods, after which the products were spread on trays and dried in a commercial drier of the tunnel type.

With carrots more attractive dehydrated products were produced on blanching by immersion, in the order named, in hot 2 per cent salt solution, hot 1 per cent sodium bicarbonate solution, or in hot water than by processing in steam. With potatoes none of the immersion methods produced better products than steam processing, but equally as good ones were obtained by immersion in hot solutions of 0.1 per cent sodium sulphite or bisulphite, and nearly as attractive ones by blanching in hot water and hot 2 per cent salt solution. Cabbage blanched by hot water and hot 2 per cent salt solution was more satisfactory and blanched with 1 per cent sodium bicarbonate solution less satisfactory than blanched with steam.

These results are thought to indicate that dehydrated products equally as attractive as those prepared by steam blanching can be prepared by blanching with immersion. The latter method is also thought to have the advantage over steam immersion of being more easily controlled.

Manufacture of sweet potato flour by the flake process, C. E. Mangels and S. C. Prescott (*Chem. Age [New York], 29 (1921), No. 4, pp. 132–135, fig. 1*).—An investigation conducted by the Bureau of Chemistry, U. S. Department of Agriculture, of the possibility of converting a surplus of sweet potatoes into sweet potato flour is reported briefly. The flake process successfully used for the preparation of flour from white potatoes proved unsatisfactory on account of low yield and the poor color and texture of the product.

Preparation of sweet potato sirup, H. C. Gore (*Chem. Age [New York], 29 (1921), No. 4, pp. 151–153, figs. 2*).—Detailed directions are given for the preparation of sweet potato sirup as developed at the Bureau of Chemistry, U. S. Department of Agriculture. Although it has been found possible to make the sirup without malt (E. S. R., 44, p. 615), it is stated that the best results are obtained with the use of a small proportion of barley or wheat malt.

Glucose and starch from maize, T. D. Hall and G. M. Hay (*So. African Jour. Indus., 3 (1920), No. 7, pp. 597–605.*—Data are presented on the glucose, starch, and oil yield of three South African varieties of maize, Brazilian flour corn, Hickory King, and Chester County.

The prickly pear (Opuntia).—Possibilities of its utilization, C. F. Juritz (*So. African Jour. Indus., 3 (1920), Nos. 8, pp. 687–693; 9, pp. 803–814*).—This paper deals with the various industrial possibilities of the prickly pear (Opuntia), including its use as an article of human diet, a potash fertilizer, a fiber for paper making, a dye, a mucilaginous glaze or dressing for textile fabrics, and as a source of sugar, vinegar, industrial alcohol, oxalic acid, and oil. A list of 26 literature references is appended.

Larch (Venice) turpentine from western larch (Larix occidentalis), S. A. Mahood (*Jour. Forestry, 19 (1921), No. 3, pp. 274–282*).—A physical and chemical examination of the oleoresin from western larch (*L. occidentalis*) is reported. The oleoresin, which has the consistency of honey, is amber in color, has a slightly bitter taste and agreeable odor, and was found to contain approximately 16 per cent of a volatile oil consisting chiefly of α-pinene together with smaller amounts of β-pinene and α-limonene. The nonvolatile portion consisted of a resin possessing acid properties but yielding no crystalline product. The principal constants of the oil were acid number 90.2, saponification

number 97.6, ester number 6.4, and specific gravity 1.0054. It is pointed out that while the acid value is high and the ester value low as compared with the commercial standards for Venice turpentine, the values more nearly approach those of the oil from *L. decidua* than do the results obtained by Schorger on Douglas fir turpentine (E. S. R., 37, p. 411).

"Two properties make Venice turpentine of value for particular purposes: It does not readily become hard on exposure; and, after standing, crystals do not form in it. The oleoresin from western larch possesses these properties, and tests made by a commercial firm indicate that western larch turpentine is a satisfactory material for all those industrial purposes for which Venice turpentine is ordinarily used."

METEOROLOGY.

Meteorology and agriculture, E. Gold (*Scot. Jour. Agr., 4 (1921), No. 3, pp. 252–258, fig. 1*).—This article briefly explains the making and use of the weather forecasts issued by the British Meteorological Office.

Reference is made to the studies of Shaw and Hooker on the relation of autumn rainfall on the succeeding season's crops. These studies showed that "broadly speaking, a dry autumn favors the cereal and bean crops of the succeeding year, and mild weather in January and February has the same tendency though in a less marked degree. Rain in April and May is favorable to oats and hay, whereas it is of practically no importance to barley and wheat. All cereals benefit by cool weather in May, June, and July. These results refer to the east of England, and more extended investigations in different parts of the world, notably in Sweden, India, and America, indicate that for each crop there is a 'best' average weather. If the rainfall or temperature of a district is normally above this best average, then the crop benefits by a rainfall or temperature below the normal and vice versa. Ultimately we may hope to arrive at a selection of crops which are the most appropriate for the weather of a district because in that way the earth will yield on the average the best return that is possible."

Underground water and meteorological factors, P. Ototzky (*Quart. Jour. Roy. Met. Soc. [London], 47 (1921), No. 197, pp. 47–54; abs. in Sci. Abs., Sect. A—Phys., 24 (1921), No. 282, pp. 400, 401*).—This is a summary of the author's extensive researches both in the laboratory and under natural conditions.

"The outstanding conclusion is that the variations in the level of the water in a well can not be identified with those of the underground water-level, but that the régime differs. A well acts as a manometer; for example, the immediate rise in the well level in response to precipitation is due to an increase in the hydrostatic pressure of underground gases caused mainly by the direct weight of precipitated water and transmitted by the underground water, of which the level is somewhat depressed. The investigation embraces the effect of air and soil temperature, barometric pressure, thawing of snow cover, and precipitation on underground and well water-level. It is part of a more extensive inquiry in which factors other than meteorological are considered, e. g., influence of forests, vegetable transpiration, geological factors, etc."

Influence of the relief and the heating of the soil on surface winds, O. Mengel (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 23, pp. 1432–1434; abs. in Rev. Sci. [Paris], 59 (1921), No. 12, p. 346*).—From a study of winds at three stations in the eastern Pyrenees the author concludes that the surface or geographic winds are the resultant of two components. One of these is dependent upon the relative position of the areas of high and low

pressure, which he designates barometric wind, and the other intimately related to the topography, which is designated topographic wind.

Cloud systems, P. Schereschewsky (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 23, pp. 1429–1431; abs. in Rev. Sci. [Paris], 59 (1921), No. 12, p. 346*).—From simultaneous observations at all the European stations the author concludes that there is a small number of cloud systems which he designates as mobile, fixed, and transition. In the intervals between these systems the sky is either clear or traversed by cirrus or cumulus clouds characteristic of fine weather.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 8 (1921), Nos. 1, pp. [192], pls. 3, fig. 1; 2, pp. [194], pls. 3, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1921, respectively.

Meteorological observations [at the University of Maine, Orono], J. S. Stevens (*Maine Sta. Bul. 295 (1920), pp. 224, 225*).—A tabular summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1920. The mean temperature for the year was 41.88° F., as compared with 43.11° for 52 years; the precipitation was 40.51 in., as compared with a 52-year mean of 39.73 in. The snowfall was 142.75 in., the number of clear days, 176.

Meteorological summary, 1919 (*Oklahoma Sta. Rpt. 1920, p. 56*).—Monthly and annual means of temperature, precipitation, cloudiness, and wind at the station are given in a table. The mean annual temperature was 59.36° F.; the highest 103°, August 6; the lowest —2°, January 3. The annual precipitation was 33.2 in.

Meteorological report for 1919, F. E. Hepner (*Wyoming Sta. Rpt. 1920, pp. 141–143*).—Observations at Laramie, Wyo., on pressure, temperature, precipitation, humidity, wind, and cloudiness are summarized for each month of 1919.

"The year was abnormally dry and warm. The total precipitation, 8.82 in., nearly one-half of which occurred after the growing season, was the lowest in 18 years. . . . This scarcity of water was the cause of a complete failure of most dry farm crops, and a greatly decreased yield of irrigated crops. Coupled with this dry condition, and helping to accentuate the ill effects resulting therefrom, was a temperature averaging considerably above normal all during the growing season. . . . A killing frost occurred on September 22. Most crops not yet harvested were mature enough to escape injury, so practically no damage occurred."

SOILS—FERTILIZERS.

The physical investigation of soil, B. A. Keen (*Sci. Prog. [London], 15 (1921), No. 60, pp. 574–589*).—In a contribution from the Rothamsted Experimental Station, soil physics is discussed in four broad sections, namely, the dimensions of the individual soil particles and the manner of their arrangement, soil moisture, soil temperature, and soil atmosphere.

Cause of the yield-increasing influence of the addition of clay to sand soil, O. Lemmermann, A. Einecke and H. Wiesmann (*Landw. Jahrb., 50 (1917), No. 4, pp. 649–677, pls. 3*).—Physical and chemical studies and vegetation experiments are reported, leading to the conclusion that the favorable influence of adding clay to sand is not due to plant stimulation or improvement in moisture conditions, but more probably to the ability of the clay to remove unfavorable properties of the nutritive solution.

Soil survey of the Grass Valley area, Calif., E. B. WATSON and J. B. HAMMON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 40, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 280,960 acres lying mainly in Nevada County in north-central California, and which is situated in the foothill belt of the western slope of the Sierra Nevada Mountains. The topography is rolling, hilly, and steep, and the ruggedness increases from the western part toward the eastern boundary. The area is drained by the Yuba and Bear Rivers.

The soils of the area are almost exclusively of residual origin. Including rough broken and stony land, placer diggings, and riverwash, 12 soil types of 7 series are mapped, of which the Aiken stony clay loam covers 44.6 per cent of the area.

Soil survey of Iowa.—Reports 4–12, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpts. 4 (1918), pp. 48, pls. 2, figs. 11; 5 (1918), pp. 48, pl. 1, figs. 11; 6 (1918), pp. 48, pls. 2, figs. 16; 7 (1918), pp. 52, pl. 1, figs. 18; 8 (1918), pp. 64, pls. 2, figs. 23; 9 (1919), pp. 56, pl. 1, figs. 17; 10 (1919), pp. 48, pl. 1, figs. 17; 11 (1919), pp. 44, pl. 1, figs. 15; 12 (1919), pp. 54, pl. 1, figs. 11*).—These reports present analyses and greenhouse and field experiments to determine the composition, fertilizer requirements, and crop adaptations of the different soil types of the respective counties.

No. 4, Webster County.—This survey deals with the soils of an area of 456,960 acres in north-central Iowa lying entirely within the Wisconsin drift soil area. The southern part of the county is level, and in the northwestern part there are numerous hills and ridges. Drainage is considered to be essential for many of the soils.

The soils are grouped as drift, terrace, and swamp, of which the drift soils cover 94.4 per cent of the area. Including peat and muck, 12 soil types of 6 series are mapped, of which the Webster loam, the Carrington loam, and Webster clay loam cover 46.6, 23, and 22.1 per cent of the area, respectively.

The studies of the individual soil types indicate that drainage is one of the chief requirements for successful crop production. The soils are not generally deficient in lime and, while the content of organic matter varies widely, the soils as a whole are not noticeably deficient in that material. There were no profitable returns from the use of phosphatic and potassic fertilizers.

No. 5, Lee County.—This survey deals with the soils of an area of 327,040 acres in extreme southeastern Iowa lying partly within the Mississippi loess soil area and partly within the southern Iowa loess soil area. The topography is that of a broad upland plain, the surface of which is for the most part slightly undulating to rolling. Drainage is said to be on the whole very satisfactory.

Loess soils cover 79.8 per cent of the area. Twenty soil types of 9 series are mapped, of which the Grundy silt loam, Lindley loam, Putnam silt loam, and Memphis silt loam cover 27.5, 23.7, 11.4, and 10 per cent of the area, respectively.

The soils are generally acid in reaction and require applications of lime. Organic matter is present in considerable amounts, but applications of farm manure have proved profitable. Phosphorus fertilization has not always proved profitable. It is stated that complete commercial fertilizers are probably not generally needed in the soils of the county.

No. 6, Sioux County.—This survey deals with the soils of an area of 489,600 acres in northwestern Iowa lying entirely within the Missouri loess soil area. The topography varies from undulating to sharply rolling. The county is said to be thoroughly drained.

Loess soils cover 80.8 per cent of the area. Including riverwash and rough broken land, 12 soil types of 6 series are mapped, of which the Marshall silt loam covers 80.8 per cent of the area.

The soils are rarely acid, but many areas in the county respond profitably to applications of manure owing to the low organic matter content. Phosphorus fertilization has so far not proved profitable.

No. 7, Van Buren County.—This survey deals with the soils of an area of 308,480 acres in southeastern Iowa lying entirely within the southern Iowa loess soil area. The county is roughly divided into two triangular areas by the Des Moines River which cuts the county diagonally from northwest to southeast. In the northeastern part the topography is rough and broken, and the southwestern part is cut by narrow valleys. The drainage of the county is said to be as a whole fairly good.

Loess soils cover 81.6 per cent of the area. Fifteen soil types of 9 series are mapped, of which the Clinton and Grundy silt loams cover 42.4 and 36.7 per cent of the area, respectively.

Many of the soils of the area are acid and need lime and are deficient in organic matter. The use of phosphorus fertilizers may be profitable now, and it is considered certain that they will be needed in the future. Complete commercial fertilizers are not recommended as profitable.

No. 8, Clinton County.—This survey deals with the soils of an area of 442,240 acres in central-eastern Iowa. The surface of the county is divided roughly into three areas of distinctly different physiography and topography. The Kansan drift plain, with its loess covering, is the most elevated and forms a gentle slope. The Iowan drift plain is generally smooth to almost level. The bottom lands form the third physiographic division. In general, drainage is well established.

Loess soils cover 52.5 per cent of the area. Including muck and riverwash, 27 soil types of 11 series are mapped, of which the Clinton, Muscatine, and Carrington silt loams cover 29.2, 22.2, and 17.1 per cent of the area, respectively.

Many of the soils are deficient in organic matter, and large crop increases are obtained from applications of farm manure. Phosphorus, while deficient in these soils, has not yet given profitable returns. Practically all the soils of the county are acid in reaction and therefore in need of lime.

Information on the prevention of erosion is also included.

No. 9, Scott County.—This survey deals with the soils of an area of 267,486 acres in central-eastern Iowa lying partly within the Mississippi loess soil area and partly within the Iowan drift area. The soils are partly loessial and partly glacial in origin, and topographic conditions are influenced considerably by the origin of the soils. Drainage is well established with a few exceptions.

Loess soils cover 70.3 per cent of the area. Including muck, 26 soil types of 12 series are mapped, of which the Muscatine, Clinton, and Wabash silt loams cover 52.1, 15.1, and 14.4 per cent of the area, respectively.

The studies showed that the soils are generally acid in reaction and in need of lime. The greenhouse experiments especially indicated the value of farm manure in these soils. The phosphorus content of these soils is deficient, and the greenhouse experiments showed that phosphorus fertilizers may prove profitable in the field. For general farm crops it is stated that the needs of the soils for permanent fertility are supplied by the use of manure, lime, and phosphorus.

No. 10, Ringgold County.—This survey deals with the soils of an area of 345,600 acres in southwestern Iowa lying within the southern Iowa loess soil area. The topography of the upland plain of the county is generally undulating and gently rolling to rolling. Only a very small area of upland is poorly drained, and there is not one square mile of land in the county without a drainage outlet.

Drift soils cover nearly half of the area. Eleven soil types of 7 series are mapped, of which the Shelby loam, Grundy silt loam, and Wabash silt loam

cover 49.3, 33.2, and 14.4 per cent of the area, respectively. The soils are said to be quite generally acid and in need of lime, and it is recommended that manure be used in liberal amounts to increase the organic matter, which is deficient in some of the soils. The opinion is also expressed that phosphorus fertilizers may prove of value in some cases.

No. 11, Mitchell County.—This survey deals with the soils of an area of 298,880 acres in central northern Iowa lying entirely within the Iowan drift soil area. The surface of the county is in general a gently undulating plain. The natural drainage as a whole is quite adequate.

Drift soils cover 86.9 per cent of the area. Including meadow and muck, 16 soil types of 11 series are mapped, of which the Carrington silt loam covers 74.4 per cent of the area, and is considered the most important soil type.

The soils were found to be quite generally acid, requiring applications of lime. Many of the soils are deficient in organic matter, and the application of farm manure or green manure is recommended. The soils are also deficient in phosphorus, and the greenhouse experiments indicate that the use of phosphorus fertilizers in the field may be profitable. Complete commercial fertilizers are not recommended for general use in the county.

No. 12, Clay County.—This survey deals with the soils of an area of 360,320 acres in northwestern Iowa lying entirely within the Wisconsin drift soil area. The surface of the county is in general nearly flat or gently undulating. It is stated that while much of the upland in the county has been well drained naturally or by the use of tile, there are still some areas where drainage would be of value.

Drift soils cover 73.4 per cent of the area. Including muck and peat, 15 soil types of 7 series are mapped, of which the Carrington loam, the Webster silty clay loam, the Carrington silt loam, and the Lamoure silty clay loam cover 31.3, 20.2, 15, and 11.9 per cent of the area, respectively.

The studies show that some of the soils are of acid reaction and require lime. The supply of organic matter is sufficient in most cases, although many of the types have been found to respond profitably to applications of farm manure. The phosphorus supply is deficient in practically all of the upland soils of the county.

Soil survey of Newberry County, S. C., W. J. Latimer et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 46, fig. 1, map 1*).—This survey deals with the soils of an area of 384,640 acres in northwestern South Carolina, which is situated near the eastern edge of the Piedmont Plateau. The county is well drained and topographically represents a well developed system of low rolling ridges with a narrow broken border along the streams.

The soils are of residual, old alluvial, and recent alluvial origin. Including meadow and rough stony land, 16 soil types of 10 series are mapped, of which the Cecil sandy clay loam, Cecil sandy loam, Appling sandy loam, and Wilkes sandy loam cover 42.2, 12.2, 10.9, and 10.2 per cent of the area, respectively.

Soil survey of Outagamie County, Wis., W. J. Geib et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils. 1918, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin, deals with the soils of an area of 413,440 acres in east-central Wisconsin, which has topographic features characteristic of a glacial region. The eastern, central, and southern parts, comprising about two-thirds of the total area, have a surface covering of glacial drift and are undulating to rolling. The natural drainage of this region is imperfect. The topography of the northwestern part of the county for the most part ranges from almost level to gently undulating. Large areas of poorly drained land, consisting mainly of peat marshes, occur within this level region.

The soils of the county are of glacial, lacustrine, and alluvial origin. Including peat, 25 soil types of 10 series are mapped, of which the Kewaunee loam, peat, and Kewaunee fine sandy loam cover 15.2, 14.5, and 12.1 per cent of the area, respectively.

Influence of partial sterilization on the composition of the bacterial flora of soil, G. TRUFFAUT and H. BEZSSONOFF (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 21, pp. 1278, 1279*).—Treatment of the soil with calcium sulphid, orthodichlorocresol, and metadichlorocresol reduced the bacterial content from 75 to 80 per cent within 12 hours. After 8 days the bacterial content increased to from 6 to 8 times that in untreated soil, but decreased again after 12 days, gradually returning to somewhere near normal but never to the original content. This varied somewhat with the method of experiment.

The results of these experiments are also taken to indicate that anaerobic bacteria compose the greater part of the bacterial content of soil which develops after partial sterilization. Nitrifying bacteria appeared to be generally destroyed. A further support of the theory of the predominance of anaerobic bacteria is the fact that *Bacillus butyricus* made up 45 per cent of the flora of treated soils and only from 5 to 10 per cent of that of untreated soils.

Comparative study on the microflora and the nitrogen content of soils partially sterilized by calcium sulphid, G. TRUFFAUT and N. BEZSSONOFF (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 4, pp. 268–271*).—Three series of experiments are reported which showed that when a strong treatment of a mixture of sulphids and aromatic carbon compounds is given soils in porous pots, oxidation being constant, the aerobic conditions produced favor the loss of ammoniacal nitrogen and are unfavorable to the development of anaerobic bacteria such as *Bacillus butyricus.*

If under the same conditions the soils are cropped, the nitrogen losses are smaller. The use of a maximum treatment of 150 kg. per hectare (133.5 lbs. per acre) of calcium sulphid on cropped soils, in spite of the strong use of nitrogen by crops, prevented the soils from becoming deficient in this element.

The improvement of peaty soils, E. J. RUSSELL (*Jour. Min. Agr.* [*London*], *27* (*1921*), *No. 12, pp. 1104–1113*).—Considerable data on European practice in the treatment of peaty soils are summarized.

The three types of peat found in England are the fen soils, the low-lying peat soils, and the high-lying peat soils. The fen soils are distinguished by the fact that they are not strongly acid and often not acid at all. Drainage is their chief requisite. They are benefited by additions of clay, but not of sand, and do not as a rule respond to lime. The most striking effects are produced by super-phosphate, but not by basic slag.

The low-lying peats require drainage as a first treatment and in addition large dressings of lime, as they are strongly acid. Two general methods of treatment are in use. In the first the land is drained, ameliorating substances are added, and the peat is cultivated as if it were normal soil. In the second method the peat is removed and sold and the under-lying formation is drained, treated, and cultivated. The second method is more popular in England because of the high market value of peat.

The high-lying peats are considered to be the most difficult to improve because the high rainfall intensifies their naturally wet character and the coldness makes agriculture very difficult. These peats are strongly acid. Field experiments with these soils demonstrated their great need for lime.

Effect of lime and organic matter on impervious Kirkland upland soil, M. A. BEESON (*Oklahoma Sta. Rpt. 1920, p. 17*).—Studies of the moisture content

and of ammonification and nitrification in this soil showed that limestone, and particularly limestone and manure, stimulated the action of ammonifying organisms and greatly increased the development of the nitrifying organisms. Determinations of total carbon indicated that some of the organic matter had penetrated as far as the second foot of the soil. Practically all of the carbon was found to be organic carbon. The greatest moisture content was found in soils treated with manure.

Soil fertility studies, C. B. WILLIAMS (*North Carolina Sta. Rpt. 1920, pp. 15–22*).—Results of soil fertility studies at the different station farms in North Carolina are summarized.

At the Buncombe farm it has been found in the main fertilizer experiments that phosphoric acid, nitrogen, and lime are the controlling constituents for better crop yields on both the upland and bottom soils of the mountain section. Acid phosphate has been found to be a better carrier of phosphoric acid than raw rock phosphate and soft rock phosphate.

The use of all fertilizer mixtures tried has failed to pay at the Washington farm. Applications of lime usually assure good crop yields, and the use of 2 tons is better than 1 ton. Marl has been found to be a poorer carrier of lime than limestone or burnt lime, and burnt lime is no better than raw ground limestone.

At the Pender farm the controlling constituents for better crop yields are, in their order, nitrogen and phosphoric acid.

At the Edgecombe farm it has been found that the ordinary fertilizer formulas in use should have more nitrogen and potash. Sodium nitrate and ammonium sulphate have been found to be two of the best carriers of nitrogen for corn and cotton.

Phosphoric acid and nitrogen are the most important factors for better crop yields at the Iredell farm.

At the Central farm organic matter is the most important consideration. The use of basic slag and crimson clover is said to be suitable to keep up the yields of cotton. Phospho-germ has given poor results with rye.

Solving soil problems, H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 31–35, figs. 3*).—The results of 16 years' fertilizer experiments by F. L. Musbach on Colby soils are briefly summarized, showing that the addition of phosphate to stable manure has been advantageous and that better results have been obtained with acid phosphate than with rock phosphate. The use of gypsum and potash did not pay, but lime increased the yield of every crop to which it was applied.

Experiments on the tile drainage of Colby soils showed that the spacing of tile lines 3 rods apart gave much better crops than spacing 4 rods apart. When the tile were spaced 3 rods apart corn was increased in yield 12 per cent, corn stover 10 per cent, barley 6 per cent, and potatoes from 5 to 20 per cent, depending upon the distance from the tile.

Tillage experiments on Colby soil showed that deep tilling and subsoiling have given negative results as a general rule.

The nitrification of stable manure nitrogen in cultivated soil, III, C. BARTHEL and N. BENGTSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 211 (1920), pp. 18; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 8, pp. 518–533*).—Laboratory studies of the nitrification of ammonium sulphate and stable manure in acid lowland moss soils are reported.

The nitrification of ammonium sulphate proceeded as powerfully in these soils as in neutral clay soils in spite of the high acidity. The available nitrogen in stable manure was nitrified in these soils and also apparently a certain amount

of the original nitrogen of the soil itself. This is considered to be due probably to the neutralizing action of the ammonia of the stable manure on the acid soils.

Liming did not increase the nitrification of stable manure nitrogen in these soils, but did increase the nitrification of ammonium sulphate and of the nitrogenous compounds contained in the soils. Ammonium sulphate was nitrified more readily in these soils than in acid clay soils. As the nitrification of ammonium sulphate proceeded, the PH value of these soils was lowered from 5.4 to 4 and then remained constant but, nothwithstanding the high acidity, nitrification proceeded unhindered.

The cause of nitrogen losses from solid and liquid manure and other organic substances, O. NOLTE and E. POMMER (*Landw. Vers. Sta., 97 (1921), No. 3–4, pp. 245–260*).—Studies of solid and liquid manure singly and combined under aerobic and anaerobic conditions showed only small nitrogen losses over considerable periods. These are attributed mainly to the evaporation of ammonia, and there is said to be no connection between ammonia and moisture evaporation.

The transformation of potassium ammonium nitrate in soil, N. KEMPF (*Landw. Vers. Sta., 97 (1921), No. 3–4, pp. 195–217*).—Studies on the transformation of potassium ammonium nitrate in sandy clay soil containing considerable organic matter are reported. Potassium ammonium nitrate is the product of the mitxure of ammonium nitrate and 40 per cent potash salts, and contains approximately 15 per cent of nitrogen and 25 per cent of the ammonium radical.

In the main experiment air-dry soil was mixed with a solution of potassium ammonium nitrate. This mixture was calculated to simulate an extra heavy fertilization with nitrogen and potash to a depth of about 8 in. After 25 days a determination was made of the water-soluble constituents, including nitric, hydrochloric, sulphuric, and silicic acids and the bases ammonium, potassium, sodium, calcium, and magnesium.

It was found that the monovalent bases ammonium, potassium, and sodium were absorbed by the soil, and that the bivalent bases calcium and magnesium took their place in solution. The nitrates varied in behavior. The chlorids were not absorbed. The silicates and sulphates first increased in solution and then gradually assumed insoluble forms. Of the monovalent bases, sodium was the most quickly absorbed at first, but later appeared to be the least absorbed. The absorption of ammonium and potassium from solution increased slowly until it was double that at the beginning. In time more ammonium was absorbed than potassium and sodium together, although at the beginning the absorption of potassium was greater than that of ammonium. Magnesium was not so active as calcium in base exchange.

The transformation of the potassium ammonium nitrate solution proceeded very rapidly during the first minute of contact with the soil and thereafter became gradually slower. After 19 days approximately one-fourth of the ammonium content and only about one-fifth of the potassium content of the solution had been absorbed by the soil.

A condition of equilibrium was established between the soil and the modified soil solution with reference to the quantities of monovalent and of bivalent bases. It is concluded, therefore, that an exchange of bases according to equivalent weights does not occur. When double the given amount of potassium ammonium nitrate solution was used, no more ammonium nitrogen was absorbed than out of the single amount of solution. Less nitrate nitrogen was absorbed from the single than from the double solution. The absorption of potassium from the double solution was independent of the time factor. This was not the case with the single solution.

Previous experiments on fertilization with raw phosphates, O. Reitmair (*Nachr. Deut. Landw. Gesell. Österr., n. ser., 4 (1920), Nos. 38–39, pp. 200–204; 40–41, pp. 214–219*).—The author summarizes a number of pot and field experiments in some detail, extending as far back as 1899, on the relative values of raw rock phosphate and other more soluble phosphates for different crops. One set especially conrpared coprolite with such materials as bone meal, Thomas slag, and Peruvian guano, and another compared superphosphate with Algerian phosphate. While the more soluble phosphates in most cases gave larger total increases in crops than the raw phosphates, it is concluded that favorable results can be obtained with raw phosphates on most all soil types.

Attention is drawn to the difficulty of drawing conclusions or of comparing results from such experiments, owing to the wide variations in conditions under which they are conducted.

The influence of lime and magnesia on the growth of plants, T. Pfeiffer, A. Rippel, and C. Pfotenhauer (*Jour. Landw., 68 (1920), No. 1, pp. 5–39*).—Studies are reported the results of which are taken to indicate that there should be a fixed relation between all plant nutrients in soil for economic reasons. On the other hand, it was found that the Loew theory that a variation from a fixed ratio between lime and magnesia injures crop growth is not always correct. Approximately the same crop yields were obtained in four different series of experiments in which the lime-magnesia ratio varied between 9:1 and 1:1. There was practically no variation in the amounts of lime and magnesia assimilated by the plants as indicated by analyses. Oats endured a high excess of lime. Crop yields were decreased when the lime-magnesia ratio was varied from 1:1 to 1:9, which is attributed not to injury by the magnesia but to a deficiency of lime. However, there are indications that there may be a partial substitution of magnesia for lime although the lime is of the greater importance in plant growth.

The content of experimental oats plants in lime and magnesia varied within wide limits and in some cases was very high. The general rule that magnesia predominates in the grain and lime in the straw was seldom confirmed. An increasing assimilation of magnesia was not accompanied by a corresponding increase in assimilation of phosphoric acid.

The content of the oats plants in potash and soda was rather high and did not decrease when the assimilation of lime and magnesia increased.

Influence of the lime-magnesia ratio on the growth of plants, O. Loew (*Jour. Landw., 68 (1920), No. 4, pp. 225–233*).—Referring to the work noted above, the author reviews data to show that although there is some evidence that a lime-magnesia ratio of 1:1 or of 2:1, according to the nature of the soil, is the most favorable for the growth of wheat and oats, pot cultures tend to give misleading results owing to crowding of the plants and consequent interference with root growth.

The influence of variable ratios of lime to magnesia on crop growth, O. Lemmermann and A. Einecke (*Landw. Jahrb., 50 (1917), No. 4, pp. 617–648, pl. 1*).—These studies led to the rather indefinite conclusion that there is probably not only an optimum ratio of lime to magnesia in soil, but that such a ratio also exists between other plant nutrients. Since such relations have not yet been established and methods for determining the relatively in minimum plant nutrient in soil are as yet not exact, it is concluded that the ratios for lime and magnesia established by Loew possess no general importance.

The removal of lime from soil by smoke gases containing sulphur dioxid, P. Rusnov (*Centbl. Gesam. Forstw., 45 (1919), No. 11–12, pp. 283–290*).—The author reviews the work of others bearing on the subject, and briefly reports studies which showed that the degree of injury to vegetation by smoke gases

stood in no proportional relation to the lime content of the soil or the removal of lime therefrom. Vegetation was injured almost as badly on soil containing from 0.7 to 1.4 per cent calcium oxid as on soil containing no lime.

On the other hand, the injury by smoke gases was closely related to the content of leaves and needles in sulphuric acid. It is concluded that this is the main source of injury.

Sulphur as a fertilizer for wheat (*Agr. Gaz. N. S. Wales, 31 (1920), No. 7, p. 462*).—A series of tests conducted at the Cowra Experiment Station farm for one year with sulphur as a fertilizer for wheat showed a net financial loss in all cases, although slight crop increases were noted in some cases. Sulphur added with superphosphate seemed to nullify the beneficial effects of the latter.

Snow as a fertilizer, M. P. Jacques (*Sci. Amer. Mo., 3 (1921), No. 4, p. 315, fig. 1*).—Data from French experiments are reported indicating the effectiveness of the snow screen as a protection against frost, and showing that over a 14-year period the soil was enriched by a total amount of nitrogen equal to 14.86 kg. per year per hectare (13.2 lbs. per acre).

Boron in relation to the fertilizer industry, J. E. Breckenridge (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 324, 325*).—Greenhouse experiments with potatoes, beans, and corn to determine the influence of boron in a 4:8:4 fertilizer, made in the laboratory and containing 0.01 per cent of borax by the quantitative method, are reported.

It was found that certain percentages of borax are detrimental to plant growth, but under favorable conditions such as optimum moisture, good drainage, etc., rapid recovery was noticeable. Corn and beans showed borax poisoning with 6 lbs. of borax per acre, and 10 lbs. per acre showed decidedly harmful results. Potatoes were not harmed but rather stimulated when 4 and even 6 lbs. of borax were used, while 8 and 10 lbs. seemed to cause less root formation at the seed and more surface roots. With optimum moisture, plants seemed to recover somewhat from the toxic effect of borax when used at the rate of 6 lbs. per acre, but in short seasons the recovery would be too late for good crop results. The opinion is expressed that the prevention of seed roots by applications of more than 6 lbs. of borax per acre would result in stunted growth and death of the plants in a dry season.

In a brief study of methods for determining boron in fertilizers the conclusion was reached that the method of Ross and Deemer (E. S. R., 43, p. 312) gives accurate results when carefully carried out, but that time may be saved by using the Jones and Anderson modification (E. S. R., 43, p. 613).

AGRICULTURAL BOTANY.

Textbook of pastoral and agricultural botany, J. W. Harshberger (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. XIII+294, figs. 120*).—This is intended to furnish information, including bibliographies, regarding the injurious and useful plants of America, particular attention having been given to the flowering forms. The book epitomizes laboratory and research work as given to veterinary students at the University of Pennsylvania.

Fundamentals of botany, C. S. Gager (*Philadelphia: P. Blakiston's Son & Co., 1916, pp. XIX+640, figs. 438*).—Of the three main parts of this introductory course in botany, the first (chapters 1–3) deals with fundamental concepts, the parts of a flowering plant, and the cell; the second (chapters 4–11) with the vegetative functions of plants; the third (chapters 12–38) with structures and life histories.

Heredity and evolution in plants, C. S. Gager (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. XIII+265, figs. 114; rev. in Nature [London], 106 (1921),*

No. 2675, p. 723).—This little book, intended originally to reprint only chapters 31 to 38 of the above course in botany, includes, as completed, considerable new matter, the older material having undergone certain modifications.

Dictionary of botanical equivalents, E. Artschwager and E. M. Smiley (*Baltimore: Williams & Wilkins Co., 1921, pp. 137*).—A dictionary of technical French and German words and phrases and their English equivalents, compiled for the benefit of readers of foreign botanical literature and containing many terms not occurring in the usual dictionary.

The generic names of bacteria, E. M. A. Enlows (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 121 (1920), pp. 115*).—The proposed generic names of bacteria are arranged alphabetically, each with the author and year of erection, reference, and characterization or description of the type species. A list of the species is appended.

New Japanese fungi, notes and translations, VIII, T. Tanaka (*Mycologia, 12 (1920), No. 1, pp. 25–32*).—New fungi as here listed include both saprophytes and parasites, some of which are indicated as species recently described elsewhere.

Questions regarding Cucurbita, J. P. Lotsy (*Genetica [The Hague], 1 (1919), No. 6, pp. 497–531; 2 (1920), No. 1, pp. 1–21, pl. 1, figs. 9*).—Several very different constant forms could be distinguished within the species *C. maxima*, also within *C. pepo*. Varieties of the same species cross easily, giving fertile segregated hybrids, though as yet crosses between varieties of different species have given no results in these experiments. Neither apogamy nor parthenogenesis was observed.

Heredity studies with beans.—III, Albinism, K. Tjebbes and H. N. Kooiman (*Genetica [The Hague], 1 (1919), No. 6, pp. 532–538, p. 1, figs. 3*).—In continuation of work previously noted (E. S. R., 43, p. 818), it is stated that a strain of dwarf beans having pale yellow seeds was cultivated for several years. This strain habitually threw a considerable percentage of albino seedlings, all of which died soon after sprouting. Seeds of three of the surviving normal green plants of this strain were gathered separately in 1916 and planted in 1917 and 1918, two of the lots giving normal seedlings only. The third gave green and white plants showing simple Mendelian segregation with green leaf color as a complete dominant. This work is to be continued.

Analysis of a spontaneous bean hybrid, M. J. Sirks (*Genetica [The Hague], 2 (1920), No. 2, pp. 97–114*).—A study of a bean hybrid, carried on since 1917, resulted in the identification of seven factors, which are discussed.

The grand period [in plant growth], H. Sierp (*Biol. Zentbl., 40 (1920), No. 10, pp. 433–457, figs. 12*).—This deals analytically with *Avena sativa* and *Pisum sativum* as regards growth factors, and changes therein and in growth rate.

Studies on the reaction of plant juices, A. R. C. Haas (*Soil Sci., 9 (1920), No. 5, pp. 341–370, pl. 1, figs. 11*).—The present paper deals with the actual and total acidities and the total alkalinity of the juices of a number of plants of agricultural importance, together with a study of the influence of liming the soil upon these acidities. The actual acidities of the different parts of the plants and their relation to one another are discussed. The effects of age, lack of chlorophyll, and changes in illumination upon the actual and total acidities of plant juices are also considered. The acidities and alkali reserve have been determined for certain conditions of growth. In order to ascertain the actual reaction of minute quantities of plant juices, a hydrogen-electrode vessel has been used that gave excellent results with only three or four drops of liquid. Such reaction appears to be affected by changes in illumination,

soil solution, age, and other conditions, indicating that the reaction of plant juices is the resultant of many processes. The results of preliminary experiments bearing upon some of these factors are reported herein.

It appears that during the life cycle of buckwheat plants the juice may undergo a marked change in its actual reaction. Determinations reported with observations to be presented later are said to indicate the existence of a close relation between the actual and the total acidity, and to show that the total acidity tends to fluctuate in the same direction as the actual acidity. Considerable support is found for the suggestion that the main specific harmful influence of soil acidity on certain plants is due to its influence in preventing the plants from securing rapidly enough the bases that are needed to neutralize and precipitate acids within the plant.

Radioactivity of potassium [in relation to plant activity], J. STOKLASA ET AL. (*Biochem. Ztschr., 108 (1920), No. 1–3, pp. 109–184, fig. 1*).—These three contributions deal respectively with the radioactivity of potassium and its significance in cells lacking or containing chlorophyll; the mechanism of the physiological operation of radium emanation and of the radioactivity of potassium on the biochemical changes in relation to the growth processes of plants; and the significance of radioactivity of potassium in photosynthesis.

Water utilization by plants in wind, BERNBECK (*Naturw. Ztschr. Forst u. Landw., 18 (1920), No. 5–6, pp. 121–141*).—This work includes chiefly studies on transpiration and the relation of transpiration and water transfer to hardiness and other characters of the plant which undergo change with age.

On the relations between growth and the environmental conditions of temperature and bright sunshine, W. E. BRENCHLEY (*Ann. Appl. Biol., 6 (1920), No. 4, pp. 211–244, figs. 17*).—Studies continued for 16 months on peas under controlled conditions are said to indicate that growth shows two well-defined periods, namely, that from the seedling stage until the plant regains its initial weight after loss by respiration, and that during which growth is obvious, lasting until desiccation begins. These periods are discussed.

The maximum growth rate is attained soon after the beginning of the second period, and under favorable conditions is maintained for several weeks. The decline is marked by definite periods, the incidence of which varies according to seasonal conditions. Response to environmental conditions under restricted food supply (though decreased) is broadly similar to response when food supply is unrestricted.

In the early stages of growth, nitrate absorption is large in comparison with dry matter production. This ratio is decreased later owing to the accumulation of the products of assimilation.

The development of photosynthetic activity during germination, G. E. BRIGGS (*Roy. Soc. [London], Proc., Ser. B, 91 (1920), No. B 639, pp. 249–268, fig. 1*).—This is the thirteenth section of a series of experimental researches on vegetable assimilation and respiration, the twelfth having been contributed by Smith (E. S. R., 43, p. 132).

Leaf development precedes photosynthetic activity, which lags behind green pigment formation, a young leaf exhibiting little or no photosynthetic activity. This is considered to indicate that photosynthetic acivity requires some factor other than chlorophyll. The potentiality of this factor rapidly increases independently of chlorophyll and of illumination.

Consideration of the results herein presented shows that the activity of the photochemical part of the photosynthetic mechanism in young seedling leaves as compared with that of more mature leaves is in some way limited, but apparently the photochemical part depends for its intensity not only upon chloro-

phyll but also upon some other factor. This factor increases with age during the early stages of leaf development.

The bearing of these facts is discussed.

[The effects of cold on seed germination], W. KINZEL (*Naturw. Ztschr. Forst u. Landw., 17 (1919), No. 4–5, pp. 139–142*),—This account, concluding studies previously noted (E. S. R., 35, p. 632), details results of observations on plants representing several genera as regards a method of freezing, and the results obtained with seed which formerly showed low germinability.

Cold resistance as an ecological factor in the geographical distribution of cacti, J. C. T. UPHOF (*Jour. Ecology, 8 (1920), No. 1, pp. 41–53, pl. 1, figs. 6*).—This paper gives the results of a study of the various degrees of resistance to cold of different species of cacti growing in the deserts of Arizona.

It appears that the vertical distribution of cacti depends upon the minimum winter temperature. The author attempts to explain the cold resistance of cacti by means of physiological experiments on the behavior of plants during freezing, an important ecological factor, upon which depends entirely the geographical distribution of the different species.

It is stated that species of cacti having relatively thick integuments are more resistant to low temperatures of short duration than those having thinner integuments, as the penetration of low temperatures through a thick integument is slower than through a thinner one. Thin integument may be accidental rather than adaptive. Since the lowest winter temperatures in the desert are often of short duration, a cactus having a thick integument may pass uninjured through temperature low enough to kill the protoplasm. Thick integument protects cactus against sudden and severe temperature changes at any season.

At higher elevations, on northern exposures, and in more northerly regions where severe cold is of longer duration, thick integuments afford no protection to sensitive plants, so that the geographical distribution of the species is confined to situations not subject to persistent cold.

The protoplasm of these plants can withstand without injury a certain low temperature for each species, below which death occurs. The quality of resistance to cold is hereditary. The temperature which damages a plant to any extent will kill that plant if continued or repeated sufficiently, and this point may be regarded as the killing temperature.

An ecological study of the algae of some sandhill lakes, E. N. ANDERSEN and E. R. WALKER (*Trans. Amer. Micros. Soc., 39 (1920), No. 1, pp. 51–85, pls. 10, fig. 1*).—It appears that the occurrence of algae in a given body of water at a given time is due, to a certain extent, to seasonal periodicity, also that the mineral and gas content of water has much to do with its algal flora. Of these factors, alkalinity is thought to be largely the explanation for the wide difference observed in the algal flora of lakes lying close together and nearly uniform as regards other factors.

In a given lake the distribution of species may be explained as due to the only variable factor, namely light intensity.

FIELD CROPS.

[Report of field crops work in Arizona], G. E. THOMPSON, R. S. HAWKINS, and S. P. CLARK (*Arizona Sta. Rpt. 1920, pp. 440–447, figs. 3*).—Varietal and cultural tests of cereals, legumes, grasses, and miscellaneous field crops are described in continuation of those previously noted (E. S. R., 44, p. 523). Kanred showed a decidedly greater rust resistance than any other wheat variety, while Early Baart, Sonora, Macaroni, and Turkey were heavily damaged by a severe rust attack general in the Salt River Valley.

[**Report of field crops work in North Carolina, 1919–20**], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1920, pp. 22–31*).—Experiments with field crops were conducted along the same general lines as noted heretofore (E. S. R., 41, p. 638; 43, p. 434).

In fertilizer trials with tobacco at Reidsville, muriate of potash demonstrated its superiority over sulphate of potash in affording protection against wildfire, produced better and larger growth, and gave immunity from sand drown. At the Granville Farm the variety known as Big Gem, Make All, or Harrison Pride possessed a superior resistance to leaf spot and made a vigorous growth, but lacked the body and general character of Adcock, Gooch, Warne, and the Orinocos. Results of rate of planting and fertilizer trials indicate that with liberal fertilizer applications an increased yield with good quality can be obtained by planting in 4-ft. rows with plants 24 in. apart in the row.

On red clay soil where cotton received nitrogenous fertilizers with a further side dressing of 50 lbs. of nitrate of soda per acre, a plat receiving nitrate of soda at planting averaged 919 lbs. of seed cotton as compared with 767 from the plat receiving dried blood.

The results of fertilizer experiments with wheat on mountain soils recommend for bottom land soils the use of at least 600 lbs. per acre of fertilizer containing 10 per cent available phosphoric acid and from 1 to 2 per cent of nitrogen. On the upland soils a treatment of 600 lbs. per acre of fertilizer containing from 10 to 12 per cent of phosphoric acid and from 2 to 3 per cent of nitrogen is advised. The nitrogen in the fertilizer used may be reduced by plowing in leguminous crops and crop residues grown in rotation with wheat.

In cotton breeding studies, one strain averaged 2,061.8 lbs. of seed cotton per acre while an inferior strain gave only 985.1 lbs. F_1 hybrids of the more distinct pure lines proved earlier, more vigorous, and more productive than either parent. Where cotton plants from North Carolina and Mississippi-grown seed were grown in comparison, the plants from North Carolina seed were earlier, slightly taller, and more productive, reversing previous results. Selections of Mammoth Yellow, Virginia, and Haberlandt soy beans averaged 5.2, 2, and 6.2 bu. per acre, respectively, more than the general crop from which they were selected.

Report of agronomy department, M. A. BEESON (*Oklahoma Sta. Rpt. 1920, pp. 16, 17, 17–22*).—Further progress of experimental work noted previously (E. S. R., 43, p. 32) is reported. The highest yielders in the variety tests included Silvermine, Boone County White, Strawberry, and Bloody Butcher corn; Nicholson Improved, Fulghum, Kherson, and Red Rust Proof oats; Triumph 44 cotton; Wisconsin rye; and Oklahoma Selected barley.

Alfalfa plats, untreated, receiving lime alone, manure alone, and lime and manure, produced acre yields of 1,618, 2,368, 6,785, and 6,783 lbs., respectively. Where peanuts were cultivated similarly until the spikes were setting, those not cultivated late gave the highest hay yield and lowest nut yield; the plat receiving ordinary cultivation when the spikes were setting made the second highest yield of hay and nuts, and the plat bedded and the vines combed out with an ordinary hay rake gave the lowest hay yield and highest nut yield.

In a test of planting kafir and cowpeas in alternate rows, kafir in 42-in. rows without cowpeas gave the highest forage and grain yields. Results of spacing tests with kafir indicated that from 9 to 12 in. between the plants in the rows will give the highest returns.

Sudan grass gave the best results when seeded from the middle to the last of April. Seedings made in rows yielded less than those made broadcast and produced hay inferior in quality owing to the excess amount of soil raked up

with the hay from the row. From 19 to 30 lbs. broadcast appeared to give the best yields.

Breeding work conducted with cotton, wheat, barley, grain sorghums, peanuts, Sudan grass, and Bermuda grass is briefly noted.

[Field crops in upper Wisconsin], H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 11–17, 18, 20–28, 29, 30, figs. 11*).—A popular discussion of practices and varieties found profitable in the production of field crops on cleared land in upper Wisconsin, together with the outstanding results of experiments with cereals, forage, and root crops by E. J. Delwiche and with potatoes by J. G. Milward at the several substations in this part of the State. The experimental work has largely been noted from other sources (E. S. R., 42, p. 433; 45, pp. 131, 226, and 229).

[Report of the] agronomy department, A. F. VASS (*Wyoming Sta. Rpt. 1920, pp. 124, 125*).—Early seeding of small grains gave the best results, confirming work previously noted (E. S. R., 43, p. 134). The leading cereal varieties included Swedish Select, Abundance, Banner, and Golden Rain oats; Red Fife, Defiance, Bluestem, and Marquis wheat; and O. A. C. No. 21, Charlottown, Smyrna, and Hannchen barleys.

Studies of the relation between the development of potato plants and yields seemed to indicate that the larger and more fully developed plants gave the greater yield. The relation was more marked with mature plants than at 50 days after planting. Where whole, one-half, and one-quarter tubers were used as seed, a direct increase in weight of tubers per hill and total weight per acre appeared as the size of the seed portion increased. Very little difference was noted between the stem and eye ends of tubers when used as seed. The average weight of tubers per hill increased directly as the distance apart of hills in the row increased by 6-in. intervals from 6 to 36 in. Although the total acre yield and also the acre yield of marketable tubers was greatest with the close planting, the percentage of marketable tubers was lowest.

[Report of field crops work in Barbados, 1918–1920], J. R. BOVELL (*Barbados Dept. Agr. Rpt. 1918–19, pp. 3–19; 1919–20, pp. 3–6*).—The continuation of experiments with various field crops along the same lines as heretofore (E. S. R., 44, p. 433) is described. Work with sugar cane has been noted from another source (E. S. R., 45, p. 132).

The improvement of grassland (*Min. Agr. and Fisheries [London], Misc. Pub. 24 (1920), pp. 50*).—A general discussion of the improvement of grassland. The various types of grassland are considered and improvement methods outlined, including fertilizing, mechanical treatment, renovating mixtures, altered methods of grazing, substitution of pasture for meadow conditions, weed eradication, and breaking the turf. Notes are also given on seed mixtures, permanent grass, alfalfa, and sainfoin meadows, and treatment of new pastures.

The improvement of grassland; Suggestions for demonstrations and experiments (*Min. Agr. and Fisheries [London], Misc. Pub. 25 (1920), pp. 16*).—Supplementing the above, this pamphlet comprises schemes simple in character, direct and practical in their object, and intended for farmers. Outlines of experimental methods and the fertilizing of meadow hay, rotation hay, and established pasture are included. The experiments devised for agricultural colleges and institutions, which are more complex and require considerable attention and supervision, include the general treatment of grassland, mechanical operations on grassland, renovating mixtures, the permanence of different varieties, and the effect on permanence of different sources of origin, seed mixtures, and harvesting seed.

The irrigation of alfalfa, F. S. HARRIS and D. W. PITTMAN (*Utah Sta. Bul. 180 (1921), pp. 3–30, figs. 8*).—Field and tank experiments on the irrigation of

alfalfa are reported, together with a résumé of earlier work on time and rate of irrigation.

In the experiments at the station the yield generally increased as the total amount of water applied increased up to 90 acre-in., the highest amount applied, but the gain in yield from the application of more than 30 acre-in. was too small to pay for the extra labor. Twenty-five in. applied in weekly quantities of 2.5 in. gave better results than 30 in. where 5 in. were applied each alternate week. With an equal amount of water frequent moderate applications gave better yields than fewer heavy ones.

Where no irrigation was applied 55 per cent of the entire yield came from the first cutting and only 14 per cent from the third. Where regular quantities of water were applied each week, from 33 to 37 per cent of the crop came from the first cutting, from 37 to 39 per cent from the second cutting, and from 25 to 30 per cent from the third cutting. Applying the water at various times of the irrigating season changed the relative yields of the different cuttings, but did not affect the total annual yield consistently.

Alfalfa yielded highest when the soil moisture content was kept constantly at 25 per cent, about the optimum for seed germination, and was not allowed to become much drier periodically. The amount of water required to produce a pound of alfalfa increased with an increase of the amount of water applied.

Corn variety experiments [at] Substation No. 3, Angleton, Tex., E. B. Reynolds and N. E. Winters (*Texas Sta. Bul. 276 (1921), pp. 5–15, figs. 2*).—Results of variety tests of corn conducted at Angleton Substation during the period 1913 to 1920, inclusive, excepting 1915, are reported. Varieties considered best adapted to the section are described briefly, and a list of those included in the annual tests is appended.

The best yielding varieties during the period included Fentress Strawberry, Hastings Prolific, Ferguson Yellow Dent, Thomas and Chisholm, with average acre yields of 33.5, 31.6, 31.5, 31.2, and 29.6 bu., respectively. In a variety-date of planting test, varieties planted about March 1 made better average yields than when planted 2 and 4 weeks later. Surcropper was first with 31.4 bu. per acre, and was followed by Ferguson and Chisholm.

Disking v. plowing corn land for oats, J. F. Cox (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, p. 83*).—Oats on corn land spring disked, fall plowed, and spring plowed produced acre yields of 94.5, 99.7, and 98.3 bu. The increase in yield from spring and fall plowing was deemed hardly sufficient to pay for the increased cost of preparing the land as compared to disking in the spring without plowing.

Growing peas for canning trade, H. C. Moore (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 106–108, fig. 1*).—Brief cultural directions.

Rejuvenation and improvement of the potato, J. Aumiot (*Rev. Gén. Bot., 33 (1921), Nos. 387, pp. 183–189; 388, pp. 244–263; abs. in Compt. Rend. Acad. Agr. France, 6 (1920), No. 35, pp. 853–857*).—Rejuvenation and improvement work with the potato by means of bud mutation, hybridization, and seed selection, conducted in France in 1920, is described. From 142 seed balls, 4,033 seedlings were secured. Those surviving attacks of pests were entirely disease resistant and showed high quality. Several hybrids exhibited high resistance to severe attacks of *Phytophthora infestans*. One hybrid, Beurre× Bolivienne, when planted in contact with varieties affected with mosaic and leaf roll showed absolute freedom from these and other diseases. Individual plants of this cross have given yields of 950, 1,600, and 1,800 gm. per hill, respectively. Regarding hybrids, the author concludes as follows:

The vigor of the resultant cross varies with the differences between parents in regard to morphological characters and their nature. The hybrid derives

its characteristics from both parents, but the influence of the male parent is dominant. The tubers of any one seedling plant are identical as to shape and as to color of flesh and skin. Seeds from a single seed ball may produce hybrids differing widely in aerial or subterranean organs, productivity, or earliness. The resistance of a hybrid may be much greater than that of the more resistant of the two parents. This applies in like manner to the other characters of the plant, e. g., vigor, hardiness, productivity, and color and quality of flesh, and is considered the fundamental principle of rejuvenation and improvement. The high fertility of the hybrids has made possible the rendering fertile of main crop varieties commonly sterile.

Chemical studies of the grain sorghums, C. T. DOWELL and W. G. FRIEDEMANN (*Oklahoma Sta. Rpt. 1920, pp. 28, 29, 57–64*).—The work reported included analyses of feterita, yellow and white milo, and Black Hull white kafir at three stages of growth; kafir flour and meal, milo flour, and mixed flours; the ash of the whole plant of these varieties in three growth stages, and the ash of the grain, meal, and flour from grain sorghums; and determinations of water-soluble nitrogen in the green plants, of the inorganic and organic phosphorus in the four varieties, of the pentosans in white milo at three stages of growth and in feterita and kafir at maturity, and of sucrose in kafir, darso, and yellow milo stalks.

The percentage of nitrogen in white and yellow milo was found to be much greater than in feterita and kafir at each of the three stages of growth. The analysis of the ash showed that the grain sorghums removed much potassium and phosphorus from the soil. While the percentage of water-soluble nitrogen is very large in the young plant, it decreases very rapidly when the plant nears maturity.

Soy beans, C. F. NOLL and R. D. LEWIS (*Pennsylvania Sta. Bul. 167 (1921), pp. 20, figs. 2*).—The culture and uses of soy beans are briefly outlined and the results of experiments conducted with the crop at the station reported.

The leading varieties in seed production included Ebony, Elton, Manchuria, Merko, Mongol, and Ohio 10,015. The largest yields of field-cured hay were made by Ohio selections, Elton, and Merko. Data on maturity, seed color, and number of seeds per pound are tabulated for the several varieties studied.

Where soy beans replaced oats in a 4-year rotation of corn, oats, wheat, clover and timothy, they produced much protein per acre, and when cut for hay, slightly more net energy. Wheat gave somewhat lower yields after soy beans than after oats due to later seeding, but the yields of other crops were practically the same. Growing soy beans with corn for silage did not give greater yields of total material than corn alone, but the presence of 10 per cent or more soy beans with corn increased the percentage of protein in the silage appreciably. No indications that corn grown with soy beans contained more protein than corn grown alone were found.

Experimentation in the crossing of sugar cane, L. QUAGLINI (*La. Planter, 66 (1921), No. 15, p. 239*).—The methods and results of hybridization work with sugar cane at the Cuban Experiment Station are outlined.

In crossing Natal Uba cane with Demerara 74, it was necessary to use a variety of wire nainsook-covered caps held in place by props. The best type of cap proved to be one with an upper diameter of 45 cm., a lower diameter of 45 cm., and a height 110 cm. On the lower rim of the cap, 40 cm. of loose cloth was tied around the canes, preventing the access of wind-blown pollen. A cane about to bloom was tied to the arrow of a pollinizing cane and the two placed within the lower part of the cap. The end of the cut pollinizing cane was placed in a can containing about 20 liters of water, with the addition

of some charcoal and camphor. About 48 good specimens were obtained, and the results were considered satisfactory.

Sugar-cane experiments in the Leeward Islands, 1918–19, A. E. COLLENS ET AL. (*West Indies Imp. Dept. Agr., Leeward Isl. Sugar-Cane Expts., 1918–19, pp. 62*).—Variety tests with sugar cane, conducted in Antigua, St. Kitts-Nevis, and Montserrat in continuation of similar work (E. S. R., 42, p. 635), are reported, together with the results of fertilizer experiments in St. Kitts in the season of 1917–18. Data on soils, rainfall, the distinguishing characters of the principal varieties included in the experiments, and the acreage under the different varieties in Antigua and St. Kitts for the crops of 1917 and 1918 are tabulated.

In Antigua, the two leading plant canes were B. 6308, with acre yields of 23.4 tons of cane and 3,840 lbs. of sucrose, and B. 3922, with 18.9 tons of cane and 3,100 lbs. of sucrose. Sealy Seedling, with an average acre yield of 6,180 lbs. of sucrose, was first of 10 varieties grown during the past 18 years. B. 10650, with an average acre yield of 14.3 tons of cane and 2,350 lbs. of sucrose, and A. 319, with 15 tons of cane and 2,010 lbs. of sucrose, were the highest yielders among ratoon canes tested during 1918–19. Of 10 varieties of ratoon canes grown during the past 17 years, Sealy Seedling was first, with an average of 3,510 lbs. of sucrose per acre.

Results of experiments with plant cane for three seasons indicate that in Antigua canes are generally ripe at 15 months of age. The question of maturity is thought due to rainfall, as in wetter climates, such as Trinidad, experimental data indicate that canes ripen in from 18 to 19 months. B. 6450, which ripens in Antigua in from 15 to 15.5 months, is considered very late in Trinidad, where it matures in from 18.5 to 19 months.

The leading plant canes grown in St. Kitts were B. H. 10(12) and Ba. 6032, with respective acre yields of 27.7 and 29.6 tons of cane and 6,350 and 5,720 lbs. of sucrose. B. H. 10(12), with 41.7 tons of cane and 8,510 lbs. of sucrose, and B. 6308, with 34.6 tons of cane and 6,280 lbs. of sucrose, were the highest-yielding ratoon canes. Observations on a number of seedlings are noted as heretofore.

In Nevis, B. H. 10(12), with 26.6 tons per acre and 7,590 lbs. of sucrose, and B. 6308, with 27.6 tons of cane and 6,960 lbs. of sucrose, were the highest-yielding plant canes. No ratoon canes were grown experimentally in Nevis.

Sealy Seedling, with 34.5 tons of cane and 7,830 lbs. of sucrose, and B. H. 10(12), with 31.3 tons of cane and 7,670 lbs. of sucrose, led in the test of plant canes in Montserrat.

Fertilizer experiments in St. Kitts, supplementing those already noted (E. S. R., 38, p. 438), showed the highest yield to accrue from combinations of readily available nitrogenous manures with potash and phosphate. However, pen manure produced increases nearly as great. Without potash and phosphate, readily available nitrogenous manures did not give marked increases in yield. The organic manures, filter-press cake and cottonseed meal, either depressed the yield or increased it but slightly.

Sunflower production for silage, E. G. SCHAFER and R. O. WESTLEY (*Washington Sta. Bul. 162 (1921), pp. 5–20, figs. 4*).—Information is presented concerning the culture and probable value of sunflowers for silage, based on data from trials at the station and other sources.

At Pullman sunflowers averaged 11.59 tons of silage per acre, while corn gave but 5.97 tons. Yields at other stations and different Washington counties show sunflowers to be profitable, especially in areas not suitable for corn. Wheat following sunflowers averaged 28.4 bu. as compared with 33.8 bu. after corn, indicating that land used for sunflowers is somewhat less suitable for

immediate wheat production than corn land. Rations containing sunflower silage are given for dairy and beef cattle and sheep, and notes on sunflower diseases are included.

Water as a limiting factor in the growth of white sweet clover (M. alba), A. N. HUME, H. LOOMIS, and J. G. HUTTON (*South Dakota Sta. Bul. 191 (1920), pp. 253–298, figs. 5*).—Experiments to determine to what extent water is a limiting factor in the growth of white sweet clover, conducted in pots containing sandy loam, silt loam, and clay soils representing large areas of the State are reported, and results obtained in earlier work along the same general line are reviewed at some length.

White sweet clover apparently lived with an amount of moisture equal to as little as 9 per cent of the dry weight of the loam soils and 11 per cent of the clay soils used, indicating that under otherwise identical conditions differences in soil type may produce variation in the amount of water required for the growth of this crop. These observations are said to agree with those of other investigators.

The amount of water utilized by the plant increased as the moisture content of the soil was increased. When the soil moisture was increased from 9 per cent to a maximum of 32 per cent, the total water used increased from 6.6 to 79 kg., indicating that sweet clover can adapt itself to the available water supply.

The average production of dry matter per plant increased with the total amount of water used. The extreme height of main stem also increased with an increase of available water up to 22 per cent of the dry weight of the soil. With a further increment of available water, the corresponding increase in the dry matter was produced by an increase in number of stems and branches and not by an extension in height of plant. The average weight of the leaves of plants and the mean area per leaf appeared to become greater with an increase in the amount of available moisture.

The average actual water requirement, the ratio of grams of water used to grams of air-dry tops produced, increased with an augmentation in the amount of water available up to 18 per cent of the weight of the soil. The water requirements for sweet clover varied according to the percentage of water available, from 675 to 789 lbs., substantially agreeing with those secured by Briggs and Shantz (E. S. R., 32, p. 127) for conditions at Akron, Colo.

Hubam clover (Hughes annual white sweet clover), J. F. COX, F. A. SPRAGG, and E. E. DOWN (*Michigan Sta. Circ. 45 (1921), pp. [4], fig. 1*).—Brief notes on the behavior of Hughes annual white sweet clover (E. S. R., 44, p. 431; 45, p. 132) in Michigan, with practical directions for seed production.

Sweet potato fertilizer experiments at Substation No. 2, Troup, W. S. HOTCHKISS (*Texas Sta. Bul. 277 (1921), pp. 3–7, fig. 1*).—In fertilizer experiments with sweet potatoes at Troup Substation in 1907, 1908, and 1911, acid phosphate gave the highest yield of the materials applied alone, and was followed by cottonseed meal. Potash alone averaged the lowest of any fertilizer used, and was apparently not required on the Susquehanna fine sandy loam soil. A mixture of acid phosphate and cottonseed meal gave the largest increase and the greatest net profit, and from 300 to 500 lbs. per acre of a 3:2 mixture is suggested for ordinary East Texas sweet potato soils.

[Report of plant breeding work in Arizona], W. E. BRYAN and E. H. PRESSLEY (*Arizona Sta. Rpt. 1920, pp. 480–483*).—The F_3 generation of a Turkey-Sonora wheat hybrid (E. S. R., 44, p. 524) appeared to confirm the classification of 4,581 F_2 plants grown to maturity into 983 plants with all hard grains, 2,285 with hard and soft grains, and 1,313 with all soft grains, roughly approaching the ratio 1:2:1. The two types of texture have segregated sharply in the sec-

ond generation and have maintained their identity. A fair indication of a single factor difference between the two types of texture also exists. The offspring of 28 of 34 selections made from the F_2 plants that headed during the heading period of the early parent had individual ranges of heading dates approximately the same as those of the parents, with about equal deviation from the mean heading dates. These facts, together with the fairly high coefficient of heredity ($r=0.4199\pm0.0952$) and the grain texture studies, are held to indicate the possibility of producing early races of hard wheat suitable for the irrigated districts of Arizona.

Wheat production as influenced by variety, time of seeding, and source of seed, E. G. SCHAFER, E. F. GAINES, and O. E. BARBEE (*Washington Sta. Bul. 159 (1921), pp. 5–34, figs. 10*).—The principal wheat varieties grown in Washington are described and their distribution, yields, and adapted areas indicated, and time of seeding and source of seed tests are reported.

The leading varieties with respective percentages grown in the State in 1918 and 1919 included Bluestem, 17.2; Early Baart, 16.6; Hybrid 128, 11.5; Marquis, 10.4; Jenkins Club, 9.2; Forty Fold, 9; Turkey, 7.5; Red Russian, 6.2; Hybrid 143, 3.4; Jones Fife, 3.1; and all others, 5.9. The average yields of field and nursery plantings during the period 1914 to 1919 showed Ruddy, Hybrid 128, Quadruple, Bluestem, Turkey Red, and Triplet outstanding, with yields ranging from 40 to 46.2 bu. per acre. "If Washington would reduce her wheats to the varieties Bluestem, Early Baart, Hybrid 128, Turkey Red, Jenkins Club, and possibly Marquis, and restrict them to the sections for which they are best adapted, more wheat would be raised, less mixture would be found, and the market value would be increased."

Where two varieties were seeded at 15-day intervals from August 1 to December 1, the highest yield was made from the September 1 seeding, closely followed by the August 15 seeding, indicating that crops seeded medium early render higher yields than those seeded very early or very late. The very early and very late seedings contained very little smut, but the yields were low.

Hybrid 128, a true winter, and Bluestem, a standard spring variety, were planted at week intervals from October 8 to March 25 during 1917 and 1918. Bluestem suffered much greater injury than Hybrid 128, and every planting of Bluestem from October 8 to February 11 was so badly winterkilled that reseeding would have been necessary to secure a profitable stand. Although Hybrid 128 showed some injury when seeded from October 8 to December 24, and was comparatively hardy, it failed to head out when seeded later than March 11. Spring varieties should not be seeded in the fall because of the danger of winterkilling, and winter varieties should not be seeded in the spring because they are not likely to head out.

Haynes Bluestem wheat grown continuously at the station produced slightly larger yields than seed of the same variety obtained each year from Minnesota and North Dakota. No improvement was gained by bringing seed wheat from these districts.

Cultural experiments with wheat, E. G. SCHAFER, E. F. GAINES, and O. E. BARBEE (*Washington Sta. Bul. 160 (1921), pp. 3–19, figs. 8*).—In tests begun in 1906, manure at the rate of 10 tons annually applied to spring and winter wheat increased the average acre yield of winter wheat 14.2 bu., while spring wheat made a gain of only 2.2 bu. Winter wheat unmanured yielded 3.8 bu. less than spring wheat. Manure rendered its largest return when plowed under in the fall for winter wheat. Winter wheat alternating with fallow, with manure plowed under in the spring of the fallow year, put on fallow in the summer, and put on wheat in early winter, made 6-year average acre yields of 38.7, 39.5, and 40 bu., respectively. However, the annual yields ranged from 27.5 to 49.5

bu., 26.4 to 53.3 bu., and 18.7 to 57.2 bu., respectively, with the first treatment making the highest yields during 3 out of 6 years.

Early plowed and well tilled summer fallow produced an average of 11.8 bu. more wheat than when plowed late and left untilled. Spring plowed land averaged 2.9 bu. more wheat per acre than fall plowed land during 14 years and outyielded the fall plowed 10 times during the period. Where spring wheat was grown continuously, the yields did not change materially whether the land was plowed 4, 6, 7, or 8 in. annually, or 5 and 8 in. in alternate years.

Winter wheat seed-bed preparation, L. L. Zook (*Nebraska Sta. Bul. 178 (1921), pp. 16, figs. 2*).—Experiments were conducted at the North Platte Substation to study the effect on winter wheat yields of plowing at different depths, early and late plowing, and of packing and seeding without packing.

Land plowed 3, 7, 10, and 14 in. deep produced average acre yields of 13.2, 15.2, 15.3, and 14.5 bu., respectively, as compared with 12 bu. from land disked only. While the increase made by 7-in. plowing over 3-in. plowing was considered sufficient to justify the greater depth, no advantage was gained by plowing deeper than 7 in. Moisture determinations made on part of the plats showed in no instance an appreciable difference in rapidity or amount of moisture storage, or in the manner or completeness of its exhaustion whether the soil had been plowed shallow, medium, or very deep.

Although higher yields were secured from early than from late fall plowing, the gain was small and the arrangement of the plats precluded definite conclusions. Better results followed packing than where packing was not practiced, the gain being more than enough to pay for the cost of the operation.

Results of experiments conducted by the U. S. Department of Agriculture (E. S. R., 39, p. 812) on substations in 12 States are cited to show the unprofitableness of deep tillage.

The improvement of damp grain, M. Heinrich (*Landw. Vers. Sta., 90 (1917), No. 1–2, pp. 49–67*).—Treatment of damp grain with a heated mixture of calcium or magnesium oxid with a bicarbonate compound, to remove excess moisture, carbonic acid, and ammonia failed to reduce the moisture content appreciably. The treatment reacted favorably on the germination of oats containing a fairly high amount of moisture, but the effect was too slight to render it of practical value. Where oats with high moisture content had free access to air, the treatment was of no practical benefit. Storing grain with high moisture content under air-tight conditions favored bacterial development detrimental to germination and vigor.

Influence of storage conditions on fresh grain (rye), M. Heinrich (*Landw. Vers. Sta., 90 (1917), No. 1–2, pp. 68–112*).—Supplementing earlier work (E. S. R., 30, p. 837), the author presents results of tests of the effect of storage conditions on newly harvested rye. Tabulated notes are given on moisture content, weight of 1,000 kernels, rate, and percentage and vigor of germination of the crop, immediately after harvest, when stored under air-tight conditions, and when stored with free access of air, with daily fluctuating temperatures (10 hours at 35° C. to 14 hours at 18°), room temperature (18°), and reduced temperature (10°). Both dry and damp grain was stored under these conditions for periods ranging from 2 to 12 weeks.

Confined atmosphere with high temperatures exercised a very harmful influence on stored fresh grain. Reduced temperatures favored storage without ventilation. Although fresh grain appeared less sensitive to confined atmosphere than old grain, it was damaged sooner and to a greater extent by fungus attacks. The development of mold fungus damaged the grain less than the development of bacteria. The germ maturity of grain cut in the yellow ripe stage increased in storage when the grain was not dried out.

Ripening after harvest took place with high as well as low temperatures, being specially expedited by high temperatures. High moisture content retarded after-ripening. With free access of air, the after-ripening was in proportion to desiccation. Reduced temperatures favored rapidity of germination in fresh grain, but as soon as the full germ maturity was reached the action was retarded. With fresh as well as weather-damaged grain, cool storage had a general good effect on germination, resulting in higher final value. Germination tests are considered necessary in many cases to determine the actual degree of depreciation.

Work of the seed inspection laboratory for the year 1919, F. S. HOLMES (*Maryland Sta. Bul. 238 (1920), pp. 25–55*).—Results are reported of purity and germination tests of 1,455 official samples of seeds collected during 1919.

The important agricultural weeds, F. BORNEMANN (*Die Wichtigsten Landwirtschaftlichen Unkräuter. Berlin: Paul Parey, 1920, 2. rev. ed., pp. 146, figs. 40*).—A practical handbook, including a general discussion of weed eradication methods followed in Germany and elsewhere, and notes on the propagation, and habits of growth of individual weeds, and eradication methods effective with each.

[The use of bagasse paper in weed eradication in Hawaii] (*La. Planter, 66 (1921), No. 15, p. 236*).—The use of bagasse paper mulch to keep down weed growth in sugar cane in Oahu, Hawaii (E. S. R., 44, p. 437), has been extended to the pineapple fields. The paper is much tougher than that used in cane fields, and is strengthened by the introduction of 40 per cent spruce pulp, or sulphite, which is added to the bagasse pulp. The young pines are planted in holes cut in the paper as it spreads over the ground. The seedlings develop, while all grass and weeds under the paper are killed off through lack of sunlight and air. For cane fields the paper is made in the following widths: Thirty in. for 4 ft. rows, 33 in. for 5 ft. rows, and 36 in. for 6 ft. rows.

HORTICULTURE.

Plant culture, G. W. OLIVER and A. C. HOTTES (*New York: A. T. De La Mare Co., Inc., 1921, 4. ed. rev. and enl., pp. 442, figs. 131*).—This is a revised and enlarged edition of a work previously noted (E. S. R., 28, p. 235).

The garden and its products, R. GODINEZ Y DIEZ (*La Huerta y sus Productos. Madrid: Libr. Angel de San Martin [1916], pp. 481, figs. 121*).—A practical treatise on vegetable gardening in two parts. The first part discusses general garden operations and the second deals with cultural requirements of the various crops.

[Report of the division of] horticulture, F. J. CRIDER, A. F. KINNISON, and D. W. ALBERT (*Arizona Sta. Rpt. 1920, pp. 469–474, figs. 2*).—Brief notes are given on experiments with citrus fruits, dates, olives, walnuts, and pecans. Self-sterility studies with 24 olive varieties indicated that a majority were self sterile. A list is given of recently introduced plants under trial.

Report of the horticultural department, 1919–20, F. M. ROLFS (*Oklahoma Sta. Rpt. 1920, pp. 46–51*).—A progress report of activities for the year ending June 30, 1920 (E. S. R., 43, p. 36). Studies of the cause of blossom drop in the tomato and the development of fruit buds are noted on page 449. A list of grape varieties ripening between August 1 and August 23 is given, Lamont being the first and Lucile the last. Herbert gave the largest yield of fruit.

Report of the horticulturist, A. G. TURNEY (*New Brunswick Dept. Agr. Ann. Rpt., 1920, pp. 90–105*).—This is a report on the condition of fruit crops

and markets in New Brunswick in 1920, together with notes on demonstration orchards. Data on the effect of nitrate of soda as a stimulant to fruit production and on coöperative dusting experiments are included.

Plant propagation and fruit culture in the Tropics, P. J. WESTER (*Philippine Bur. Agr. Bul. 32 (1920), 2. rev. ed., pp. 134, pls. 23, figs. 54*).—A revised and enlarged edition of the bulletin previously noted (E. S. R., 35, p. 642).

Notes on plant introduction work, J. J. THORNBER and J. G. BROWN (*Arizona Sta. Rpt. 1920, pp. 459–463*).—Brief descriptive and behavior notes are given of 17 plant introductions being tested in the university grounds. The Evergreen tamarisk (*Tamarix articulata*) of Algerian origin is deemed particularly desirable as a shade tree on account of its symmetrical form, rapid growth, and ease of propagation. Three Pistacia species, *P. lentiscus*, *P. vera*, and *P. chinensis*, included in the list of plants, have proved adaptable to Arizona conditions.

Peas for canning industry, H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 17, 18, fig. 1*).—It is noted that a cross between the Horsford and the Alaska pea has been found to be specially vigorous, and to show good seed-producing possibilities and resistance to root rot. Badger and Horal, two new early maturing wrinkled peas, are described as prolific and more evenly ripening than any other varieties tested.

The present status of dusting, H. H. WHETZEL (*N. Y. State Hort. Soc. Proc., 2 (1920), pp. 45–75*).—A summary, with tabulations, of experimental results with dusting in the United States and Canada.

Some preliminary results from pruning experiments, W. H. CHANDLER (*N. Y. State Hort. Soc. Proc., 2 (1920), pp. 77–84*).—A preliminary report on investigations conducted at Cornell University to determine the merits of different types of pruning.

A comparative study of little pruning, pruning to a central leader, and pruning to an open head in a variety apple orchard showed a marked increase in yield in favor of little pruning. The author points out the difficulty of pruning spreading-top varieties like Rhode Island Greening, Baldwin, and Tompkins King to a central leader. Open-head pruning of plum trees did not reduce fruitfulness to such an extent as with apples. Tabulated records of the leaf area of much *v.* little-pruned apple trees showed a marked reduction in leaf surface of the much-pruned trees. Studies with nursery apple trees showed a reduction in the number of leaves and weight of top and of roots as a result of pruning. The top growth of severely pruned 2-year-old apple trees was but 57.5 per cent that of unpruned. With Elberta and Early Crawford peaches, there was a marked reduction in root growth but none in the top.

"We must conclude from these experiments that any considerable amount of pruning dwarfs the tree, generally by more than the amount of the pruning. In case of spur-bearing trees such pruning delays the fruiting of the young tree even more than it dwarfs."

Types of flowers and intersexes in grapes with reference to fruit development, A. B. STOUT (*New York Sta. Tech. Bul. 82 (1921), pp. 3–16, pls. 7*).—This is the initial report of an investigation, conducted cooperatively by the station and the New York Botanical Garden. The material studied was obtained in the station vineyards at Geneva, where many named varieties of American and European grapes and several thousand seedlings of known parentage are grown. The flowers were examined under the microscope and drawings made to scale, with the aid of a Stufen ocular micrometer. The germination of the pollen was tested with 5, 7.5, and 10 per cent cane sugar in 1 per cent agar. The fertility of the pistils and ovules in the flowers was judged by production of fruit and seed in the vineyards.

The author concludes in part that "a summary of the variations in the flowers of cultivated varieties of grapes and of seedlings from them shows that there are many grades in the relative development of pistils and stamens.

"Complete loss of femaleness is seen in only a few cases, but various grades of rudimentary pistils are present that are incapable of yielding fruits of any kind. This evidence suggests that it is a weak grade of femaleness which is responsible for the development of seedless fruits. In near-seedless sorts, femaleness of still another grade but below that of high seed production.

"A complete morphological loss of stamens has not been found. The least male plants are perhaps among those with recurved stamens, small sterile anthers, and only aborted pollen. Such plants are able to function as females only. Plants with erect crinkled stamens and some plants with normal upright filaments are likewise unable to function as males because of impotent pollen. In the extreme there is complete loss of one or the other sex, at least functionally. Between these extremes there are various grades of relative development and functioning ability of pistils and stamens. In the perfect hermaphrodites both of these organs are highly developed and functional, and it is these types that include all of the most important and productive of the seeded grapes. . . .

"The variations in the morphological development of stamens and pistils and in their ability to function as sex organs are to be described as phenomena of intersexualism. The abortion of pollen in reflected, crinkled, and in other stamens is seen in flowers that are highly pistillate and functional as females. Conversely, extreme loss of femaleness is seen in staminate types in which maleness is highly developed. In these extremes the loss of sex is one-sided. Such one-sided impotence is characteristic of intersexualism as distinct from the sterility of hybridity, which tends to affect both sexes in the individual quite the same. . . .

"The results of the breeding work already obtained at the station indicate clearly that the use of seedless and near-seedless plants as male parents in crosses with varieties that are strongly female (perfect and imperfect hermaphrodites) give progeny that are strongly female and seed producing. . . .

"The most effective course in breeding for the development of seedless sorts is suggested by the conditions of intersexualism. Most individuals and varieties producing seedless or near-seedless fruits are strongly staminate. The former can be used as male parents on the latter, which do produce a few viable seeds. Plants strongly male and seedless can be crossed with plants strongly male but weakly female and near-seedless and, also, the self-fertilized progeny of the latter may be obtained. In this way families weak in femaleness may undoubtedly be obtained, in which a considerable number of individuals will produce seedless fruits."

Top-worked citrus trees, A. D. Shamel (*Calif. Citrogr., 6 (1921), No. 4, pp. 109, 134, figs. 3*).—A discussion of the principles and practice of top-working citrus trees. A table is included showing the comparative yields of top-worked *v.* all-orange trees, in which a slight advantage is indicated in favor of the latter.

Effect of season on the regeneration of sour orange roots, F. F. Halma (*Calif. Citrogr., 6 (1921), No. 8, pp. 273, 299, figs. 2*).—A brief account of a study conducted at the California Citrus Experiment Station in 1919 and 1920, in which renewal growth of sour orange roots pruned at different intervals was carefully observed.

"The results of this experiment showed that all of the 50 pruned roots regenerated, that is, each one produced a number of new roots close to the cut. The total amount of new growth varied with the size of the root." Roots

which were pruned from about the beginning of May to about the last of October calloused almost immediately, and new rootlets could be observed within two weeks. "On the other hand, roots which were pruned between November and April remained inactive until the end of April." The author concludes that the investigation explains why May is the best time for transplanting citrus trees.

The coconut in Dahomey, L. HOWARD (*Bul. Matières Grasses Inst. Colon. Marseille, No. 2 (1921), pp. 25–35*).—This review of the coconut industry in Dahomey calls attention to the distribution of trees, cultural practices, present status, and future development.

Crop records of oil palms, A. A. L. RUTGERS (*Meded. Alg. Proefsta. Alg. Ver. Rubberplanters Oostkust Sumatra, Alg. Ser., No. 8 (1920), pp. 3–15, pls. 2*).—This report of investigations with the oil palm (*Elaeis guineensis*) contains information on the area in cultivation, cultural and pruning practices, and pollination and yields.

Crop records of oil palms, A. A. L. RUTGERS (*Commun. Gen. Expt. Sta. Alg. Ver. Rubberplanters Oostkust Sumatra, Gen. Ser., No. 8 (1920), pp. 3–13, pls. 5*).—An English translation of the above.

Nut growing in the United States, W. G. BIXBY (*North. Nut Growers Assoc. Bul. 5 (1920), pp. 20, pls. 2*).—Practical information is given on nut production in the United States, with reference to species and their varieties, improvement, cultural practices, and yields.

Nut culture in Michigan, C. A. REED (*North. Nut Growers Assoc. Proc., 10 (1919), pp. 98–107*).—A paper on the status of nut growing in Michigan, with particular reference to 11 species which are considered to be available for use in that State.

The practical book of outdoor rose growing for the home garden, G. C. THOMAS, JR. (*Philadelphia and London: J. B. Lippincott Co., 1920 [5. ed.], rev., pp. 224, pls. 43*).—This revised edition (E. S. R., 37, p. 836) contains an additional chapter entitled Rose Development from 1917 to 1920 (pp. 219–224).

Landscape gardening, A. J. DOWNING, rev. by F. A. WAUGH (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, 10. ed., rev., pp. XV+439, pl. 1, figs. 48*).—The purpose of this new edition, extensively rearranged and modified by the addition of chapters from Downing's Rural Essays, is, in the editor's words, "not so much to make the usual revision of an old book as to bring together from all Mr. Downing's writings the best portions of his work bearing directly on the subject of landscape gardening."

Appendix II, a memoir to the author by G. W. Curtis, presents a review of his life and activities.

The rock garden, E. H. JENKINS (*London: Country Life, Ltd.; New York: Charles Scribner's Sons, 1920, new ed., rev. and enl., pp. XI+128, pls. 44, figs. 3*).—A revised edition of the work previously noted (E. S. R., 31, p. 743).

FORESTRY.

Forestry for the private owner, F. F. MOON and H. C. BELYEA (*N. Y. State Col. Forestry, Syracuse Univ., Bul. 13 (1920), pp. XIV+166, pls. 15, figs. 15*).—A handbook of forestry prepared for the assistance of the private owner, emphasizing the necessity of reforestation of idle and unprofitable lands and presenting information relative to desirable species, protection from fire, insects and diseases, thinning, harvesting and marketing, etc. A bibliography is included. Surveyor's log rule and volume tables are appended, together with a tabulation of the uses of various woods.

Results of experimental planting at Parilla Forest, W. GILL (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 6, pp. 476, 478–480*).—An experimental tree planting in the Pinnaroo district of South Australia in an attempt to grow sufficient timber to supply posts, etc., for the settlers is described. Due to meager rainfall, 12.69 in. per year over a 10-year period, none of the tested species made a satisfactory growth.

Growth and its relation to thinning—sample plat studies in mixed hardwoods, C. H. GUISE (*Jour. Forestry, 19 (1921), No. 5, pp. 546–549*).—In an experiment conducted in a young, mixed hardwood stand near Mapleton, N. Y., to determine the effect of thinning on the rate and amount of growth, three square, quarter-acre plats were laid out, one check, one lightly thinned, and one severely thinned. The diameter of every tree in each plat was determined and each tree labeled, and at the end of a five-year period the diameters were again determined. The results, presented in tabular form, show that the greatest increases in diameter and volume growth occurred in the severely thinned plat; however, the greatest actual volume was found on the check plat. The mortality rate was 4.9 per cent for the check plat, as compared with none for the severely thinned plat.

Report of the division of forestry (*Mass. Comn. Conserv. and State Forester Ann. Rpt., 1920, pp. 29–60, pls. 3*).—A report of forest activities in Massachusetts for the year ended November 30, 1920, relative to changes in organization, State plantations, examinations, nursery work, distribution of seedlings, forest survey of Hampshire County, white pine blister rust, white pine weevil, and administration of the State forests. The State Fire Warden's Report, by M. C. Hutchins (pp. 45–52) and the Report of the Superintendent of Gypsy-moth work, by G. A. Smith (pp. 53–60) are included.

Biennial report of the Forestry Commission for the two fiscal years ending August 31, 1920 (*N. H. State Forestry Comn. Bien. Rpt., 1919–20, pp. 89, pls. 3*).—A report of the activities of the commission for the period, giving information on forest fire service, control work with white pine blister rust, public forests, reforestation, survey of forest resources, the Christmas tree industry, the chestnut bark disease, taxation of forest land, etc. A financial statement is included.

Forest trees in the National Arboretum, L. PARDÉ (*Rev. Eaux et Forêts, 59 (1921), Nos. 5, pp. 134–138; 6, pp. 166–173*).—A report on the behavior of broadleaf and coniferous tree species introduced into the National Arboretum at Barres, France, during the period 1900–1920. Among the satisfactory species are *Thuja plicata, Libocedrus decurrens, Sequoia washingtoniana, S. sempervirens, Pinus laricio, Cedrus atlantica, Picea sitchensis, Abies nordmanniana,* and *Pseudotsuga taxifolia.*

Choice of species for use in plantations of pulp and paper companies in the North, H. B. SHEPARD (*Jour. Forestry, 19 (1921), No. 5, pp. 519–525*).—The adaptability of four spruce species, *Picea canadensis, P. rubens, P. mariana,* and *P. excelsa,* as material for reforestation with a view to pulp-wood production is discussed. *P. canadensis,* the white spruce, is deemed the most valuable because of its rapid growth, resistance to pests, adaptability to environment, and abundant seed supply. *P. excelsa,* the Norway spruce, is considered of possible value but not sufficiently tested.

The quebracho forests of South America, G. A. KERR (*Jour. Amer. Leather Chem. Assoc., 16 (1921), No. 4, pp. 172–202, figs. 18*).—In this article, based on personal observations upon the quebracho forests of Argentina and Paraguay, Colorado is described as the most abundant and important of three varieties and the chief source of a very important tanning extract. Data are presented

on the distribution, total resources, value, physical aspect of the tree and forests, and operations and transportation.

Wood charcoal and its manufacture, J. J. KOTZÉ (*Union So. Africa, Forest Dept. Bul. 1 (1920), rev., pp. 17, figs. 14*).—The process of charcoal burning is described and illustrated.

DISEASES OF PLANTS.

Notes on new or little known plant diseases in North Carolina in 1920, F. A. WOLF and S. G. LEHMAN (*North Carolina Sta. Rpt. 1920, pp. 55–58*).—Brief notes are given on a number of diseases observed by the authors that are thought to be worthy of permanent record. Among them are lightning injury, and associated with it, *Phoma corvina;* a root mold of cotton caused by *Penicillium spiculisporum;* a pod rot of cowpeas due to *Choanephora cucurbitarum;* pod blight of lima bean caused by *Diaporthe phaseolorum;* anthracnose (*Glomerella cingulata*) of fig; a soft rot of pepper fruits due to *Pythium debaryanum;* mosaic, anthracnose (*G. cingulata*), and Phoma blight (*Phoma* sp.) attacking soy beans; the buckeye rot of tomato (*Phytophthora terrestria*); and downy mildew of vetch, caused by *Peronospora viciae.*

Annual report of the department of plant pathology and botany, 1919–20, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 91–93*).—Notes are given on a number of plant diseases in addition to the studies of yellow-stripe disease and root diseases of sugar cane. Among the root diseases the author reports having discovered *Plasmodiophora vascularum* in the vascular bundles of stunted cane, and a survey made of the island showed that the organism, which is apparently an important factor in cane production, is quite extensively distributed. Some investigations were made of the gumming of sugar cane due to *Bacterium vascularum.*

Studies were also made of a new tobacco disease caused by *Phytophthora terrestria,* and the same fungus was found in the diseased lesions of grapefruit tree trunks.

[Plant diseases, British Guiana], J. B. HARRISON (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 16, 21, 24*).—Sugar cane root disease (*Marasmius sacchari*) showed sporadically in several plantations during the year. Ring spot (*Leptosphaeria sacchari*), rind fungus (*Melanconium sacchari*), and the leaf-sheath fungus (*Cercospora vaginae*) caused little damage, owing to increased host resistance due to favorable weather. Coconut bud rot, thought to be due to bad conditions, chiefly inadequate drainage, is controlled by employment of proper management and suitable soil. Para rubber leaf disease is still serious in some localities.

Plant diseases, [British Guiana], R. WARD (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, p. 52*).—Para rubber disease continued prevalent at two points named. Coconut bud rot was associated with inadequate drainage. Mango and breadfruit ripe rot, prevalent in 1918, proved controllable by use of Bordeaux mixture. Cacao witches' broom was less prevalent than formerly. *Marasmius sacchari* was the most prevalent disease of sugar cane.

Report on activities of the Station of Agricultural Intelligence at Montpellier, 1918, L. RAVAZ (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1919), No. 2, pp. 131–167, figs. 27*).—A brief account is given of the establishment (following a severe freeze on March 26, 1898) of the service of meteorological and agricultural information. This is followed by a detailed account, brought down to include 1918, of the development and workings of plans looking to the prevision, and, so far as possible, the prevention of grape diseases.

Cryptogamic review for 1916, with report on cereal diseases due to vegetable parasites, G. Briosi (*Bol. Min. Agr. e Indus., Com. ed Lavoro [Italy], Ser. B, 17 (1918), I, No. 1–6, pp. 1–9*).—On the plan of previous reports (E. S. R., 38, p. 351), this deals briefly with diseases of rye, oats, barley, maize, grapes, garden plants, fruits, and ornamentals. Publications issued during 1916 are listed.

The Swedish Gymnosporangiums, their hosts and specialization, J. Eriksson (*K. Svenska Vetensk. Akad. Handl., 59 (1918), No. 6, pp. 82, pls. 4, figs. 13*).—This contribution reports in considerable detail studies by the author on *G. clavariaeforme* and *G. tremelloides* and on their aecidial stages. A bibliography is appended.

[Report on] stations for recording Peronospora [outbreaks and phases], 1917, P. Voglino (*Bol. Min. Agr. e Indust., Com. ed Lavoro [Italy], Ser. B, 17 (1918), I, No. 1–6, pp. 25–30*).—The system of reporting Peronospora outbreaks initiated in 1916 was in operation during 1917. An account is given, with discussion, of observational data with tabulation of a series of outbreaks extending from May 2 to August 3, during which time 19 records were made and 8 treatments were used.

Glomerella cingulata and its conidial forms, Gloeosporium piperatum and Colletotrichum nigrum on chilies and Carica papaya, J. F. Dastur (*Ann. Appl. Biol., 6 (1920), No. 4, pp. 245–268, pl. 1*).—*G. piperatum* and *C. nigrum*, though causing much loss of fruit in Burma, are not known to be destructive to chilies in India. These fungi are considered to be identical and to be forms of *Glomerella cingulata*, which is said to be synonymous with *Gnomoniopsis* (*Glomerella*) *piperata*, the ascogenous stage of *G. piperatum*.

A new disease of *Carica papaya* is described, as caused by the conidial forms of a Glomerella showing characters indentical with those of the form found on chilies.

The study of the conidial forms of the Glomerella on *C. papaya* also shows that Gloeosporium and Colletotrichum are one and the same fungus.

A nematode disease of red clover and strawberry in the Pacific Northwest, L. P. Byars (*Phytopathology, 10 (1920), No. 2, pp. 91–95, pls. 2*).—A description is given of the nematode disease caused by *Tylenchus dipsaci*, which has been observed on red clover in irrigated fields of Idaho and Utah, and on strawberries in Oregon and elsewhere. Usually the nematode attacks only the above-ground parts of the plant, and often closely associated with it on the clover are a number of other organisms, which appear to assist in a secondary manner in causing the trouble. No consistent morphological differences have been observed between the nematode occurring on the strawberry and red clover.

The author reports finding the nematode attacking only one wild plant, *Physalis* sp., which was growing in a badly diseased field of clover in Utah. For the present it is considered inadvisable to plant on infested lands any of the crops which are known to be damaged by this nematode. The more important of these crops are beans, potatoes, onions, peas, alfalfa, and most of the clovers, vetches, and grains.

[Seed treatment for cereal smuts], L. Malpeaux (*Vie Agr. et Rurale, 9 (1920), No. 44, pp. 260–264, figs. 2*).—An account is given of injury to cereals due to rusts during 1920, and (in tabular form) of experimentation on seed treatments for smuts, with discussion of practical measures in this connection.

Report on the results of experiments on the treatment of oats for the prevention of smut, W. W. Philip (*Dumfries, Scot.: J. Maxwell & Son, 1916, pp. 10; noted in Scot. Jour. Agr., 2 (1919), No. 2, pp. 222, 223*).—Of the four treatments employed in these tests, viz. copper sulphate, hot water, a patent

smut dressing, and formalin at the rate of a half pint (of the 40 per cent solution) in 18 gal. water to 20 bu. oats, only the last mentioned treatment proved to be efficacious in 1915, giving a substantial increase during that year. Repetition of this treatment on a larger scale (42 acres in 1916 an 112 in 1917) gave like results.

How to protect wheat: Some notes on fungus pests (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 548–553, fig. 1*).—Though diseases of wheat are said to have been very numerous in Great Britain in 1920, the most serious were probably bunt or stinking smut, yellow rust, and black rust. These are discussed in connection with known or proposed measures for decreasing loss due to these causes.

The occurrence of wheat downy mildew in the United States, W. H. Weston, jr. (*U. S. Dept. Agr., Dept. Circ. 186 (1921), pp. 6*).—The author reports the occurrence of the downy mildew of wheat due to *Sclerospora macrospora* in Tennessee and Kentucky. A preliminary study made of the district in which the disease was discovered shows that it is restricted almost entirely to low-lying, poorly drained fields or parts of fields in which the seedlings had been subjected to excessive moisture. In addition to the varieties of wheat commonly cultivated in the region, it was also found on *Bromus commutatus*. The losses occasioned by this disease both in the west Tennessee and Kentucky districts as reported are said to be apparently very slight, but the author desires to call the attention of plant pathologists to this disease so that its distribution may be discovered as soon as possible.

Septoria glume blotch of wheat, H. R. Rosen (*Arkansas Sta. Bul. 175 (1921), pp. 3–17, figs. 4*).—A description is given of a marked spotting of glumes and rachises of a large number of wheat varieties which has been under observation in Arkansas for several years. The most conspicuous symptoms are said to be on the glumes, particularly the outer ones, which are noticeably discolored, the discoloration appearing as brownish or purplish-brown spots or blotches, often with a hoary appearance, or brownish with a grayish-white center. While the glumes, including the beards in bearded varieties, are the most likely to be attacked, discolored spots may also be observed on any part of the head.

A study has been made of the fungus, and its characteristics are said to agree very well with those described by Berkeley for *Septoria nodorum*. Infection experiments were carried on by the author with the fungus and the symptoms produced were very similar to those occurring under natural infections. No experiments were undertaken to control the disease, but it is thought that the use of early maturing varieties and proper crop rotation would help in controlling the disease.

Take-all disease in wheat, R. Waters (*New Zeal. Jour. Agr., 20 (1920), No. 3, pp. 137–143, figs. 3*).—This note deals with the incidence of take-all (*Ophiobolus graminis*) in New Zealand, its similarities to other diseases, its perpetuation, the susceptibility of wheat and other plants, and control measures. These include the rolling and burning of stubble, drainage, suppression of susceptible plants, rotation, and destruction of straw from infected areas.

Varietal susceptibility of beans to rust, F. D. Fromme and S. A. Wingard (*Jour. Agr. Research [U. S.], 21 (1921), No. 6, pp. 385–404, pls. 5*).—In a previous publication (E. S. R., 40, p. 845) the authors described the field behavior of a large number of bean varieties with respect to their susceptibility to rust. In the present paper, which is a contribution from the Virginia Experiment Station, the various phenomena found in bean rust infection and development on certain varieties of beans, especially under greenhouse conditions, are described. Considerable attention has been paid to methods of investigation, and the

technique of inoculation and method of record are described, the latter being believed to be a satisfactory method for expression of the relative rust susceptibility of bean varieties.

Of the varieties studied, those with indeterminate growth (pole beans) were found more susceptible than those with determinate growth (bush beans). Green-pod varieties were found more susceptible than wax-pod beans, and varieties having solid red or red-mottled seed were rust resistant, while varieties with white seed were more susceptible to the disease than those of any other color. Varieties of beans of the marrow type were found rust resistant, and those of the pea-bean type proved to be the most susceptible class. Field tests which supplemented the greenhouse tests are said to have demonstrated that greenhouse tests afforded a reliable index of the field behavior of a variety with respect to rust infection.

The authors made some studies relative to the appearance of biologic forms of the bean-rust fungus, and the existence of two biologic forms was demonstrated, but the host ranges have not yet been completely worked out.

A mosaic disease of cabbage as revealed by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1883–1892*).—A disease of cabbage, marked by dwarfing, certain color changes, metallic luster, brittleness, defective root development, and other changes all tending toward lessened crop returns, was investigated in 1918 by using, along with other methods, those employed in the study of spinach disease as noted on page 448.

This cabbage disease is characterized by denitrification in the affected tissues. The nitrates are in part changed to ammonia which is lost as such, in part to nitrites which bring about the elimination of elementary nitrogen. Leaves suffer denitrification in much higher degree than do the roots. Diseased tissues show an increased proportion of protein and protein nitrogen. This is thought to indicate that affected plants build proteins from lower nitrogenous compounds, and that the protein nitrogen is not attacked by nitrous acid, the protein and protein nitrogen being related in the diseased plants to a smaller nitrogen content and a smaller quantity of tissue. Significant differences between healthy and diseased cabbage plants are discussed.

Heart rot, rib rot, and leaf spot of Chinese cabbages, N. A. Brown and R. B. Harvey (*Phytopathology, 10 (1920), No. 2, pp. 81–90, figs. 4*).—The authors report that Chinese cabbage, both loose and tight-headed varieties, is subject to the black rot disease produced by *Bacterium campestre*. The disease is said to be very destructive in seasons of high temperature with excessive moisture. The organism was found to enter the plant through the water pores of the leaf and through the wounds in roots and stem. Insects were also found to act as carriers. The soft rot organism destroys the heart at once. The spotting occurring on the leaves is unlike that due to the fungus *Alternaria brassicae*, which is confined to the outer leaves of the head.

For the prevention of the disease the practice of sanitary methods in the fields and the treatment of the seed with corrosive sublimate solution or formalin are recommended.

Treatment of celery seed for the control of Septoria blight, W. S. Krout (*Jour. Agr. Research [U. S.], 21 (1921), No. 5, pp. 369–372*).—In a contribution from the Massachusetts Experiment Station, the author gives the results of a study of the effect of aging celery seed on the vitality of the spores and mycelium of *S. petroselini apii*, and the use of hot water as a disinfectant. Tests were made of the germination of celery seed of different ages in connection with the occurrence of the fungus, and it was found that by purchasing seed 1 or 2 years old and retaining it until it was 3 or 4 years old the grower could not

only eliminate the fungus but also have an opportunity to test the seed for pureness of strain, quality of plant produced, and elimination of seed weak in vitality.

The vitality of the conidia and the mycelium of the fungus was found to be very low at the end of 1 or 2 years. Celery seed 3 or 4 years old gave good germination.

When the seed was treated with hot water the vitality of spores and mycelium in the pericarp was found to be destroyed at 48 to 49° C. (118.4 to 120.2° F.) without seriously injurying the germinating power of the seed.

Choanephora cucurbitarum on chilies (Capsicum spp.), J. F. DASTUR (*Ann. Bot. [London], 34 (1920), No. 135, pp. 399–403 pl. 1*).—An account is given of the new disease of chilies ascribed to *C. cucurbitarum*, showing as a wet rot and drooping of the infected tender parts and a die-back of the branches. The infection may start from the flowers or more rarely from the flower buds. Sporangia, chlamydospores, and zygospores develop in cultures, conidia apparently only on the host under natural conditions.

Impairment of clover seedings reported, A. D. SELBY and R. C. THOMAS (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 90–92*).—A popular account is given of a serious root rot of red clover that has been observed in different parts of Ohio. The disease appears to be due to a species of Fusarium which causes much wilting and dying of the growing parts of the plants. On account of the possible relation of this disease to corn root rot and wheat scab, observations are being conducted to determine the effect of the use of infected wheat straw applied with manure on the occurrence of the disease.

Clover stem rot (*Min. Agr. and Fisheries [London], Leaflet 271 (1020), pp. 6, figs. 3*).—Clover stem rot may be due to the nematode *Tylenchus devastatrix* or to the fungus *Sclerotinia trifoliorum*. A description is given of the fungus disease, with points of distinction between this and the nematode disease.

Potato tuber diseases (*Meded. Phytopath, Dienst Wageningen, No. 9 (1919), pp. 12, pls. 3*).—Potato tuber diseases here discussed in connection with control measures include Rhizoctonia disease (*R. solani*), lenticel outgrowths (which are to be distinguished from wart disease, which is also discussed), Fusarium rot, ordinary scab or scurf (*Oospora scabies*), misshapen tubers, red rot (*Phytophthora erythroseptica*), green tubers, late blight, silver scurf (*Spondylocladium atrovirens, Phellomyces sclerotiophorus*), leaf curl (*Verticillium* sp.), bacterial and undetermined diseases described, nematode attack (*Tylenchus devastatrix*), and powdery scab (*Spongospora subterranea*).

Degeneracy in potatoes, S. MOTTET (*Jour. Agr. Prat., n. ser., 33 (1920), No. 14, pp. 237–239, figs. 2*).—A brief account is given of conditions associated with splindling sprout of potato. This appears in different varieties and may show in different degrees in the several sprouts on the same potato, but has not yet been successfully identified as to its causation, though associated conditions are noted herein.

Potato leaf roll, D. FOLSOM (*Maine Sta. Bul. 297 (1921), pp. 37–52, pls. 4, figs. 3*).—This bulletin is designed to present the more essential facts presented in another publication (E. S. R. 45, p. 145), relating to leaf roll, net-necrosis, and spindling-sprout of the Irish potato.

Summarizing the investigation, the author states that leaf roll is very prevalent in a number of portions of the United States and is increasing in Maine. It causes a rolling, rigidity, and discoloration of the leaves, dwarfing of the plant, net-necrosis of the tubers, and a great reduction of the yield. The cause of leaf roll is said to be located in the juice of the plant, is transmitted into the tubers, and can not be reached by applications upon the outside of the plant or tubers. The disease is infectious and can be transmitted from one plant to

another by plant lice, but by no other means thus far tested except grafting. Leaf roll has been controlled in northeastern Maine by tuber selection and roguing. Where plant lice are abundant or leaf roll very prevalent, it is thought probable that additional precautions, such as isolation of seed plats and spraying for the control of plant lice, may be required.

Transmission of the mosaic disease of Irish potatoes (*Maine Sta. Bul. 295 (1920), pp. 223, 224*).—An abstract of a paper previously noted (E. S. R., 43, p. 546).

A disease-resistant potato for southern markets, H. L. Russell (*Wisconsin Sta. Bul. 332 (1921), p. 28*).—Attention is called to a strain of Triumph potatoes that has shown remarkable resistance to mosaic. This strain was distributed to growers in 1920, and about three carloads of potatoes are said to be available for 1921 plantings, either in Wisconsin or in the South, for early potato production.

Potato scab, J. W. Brann and R. E. Vaughan (*Wisconsin Sta. Bul. 331 (1921), pp. 27, figs. 11*).—A description is given of potato scab with suggestions for its control. The most satisfactory treatment has been found to be soaking the potatoes from 1½ to 2 hours in a solution of corrosive sublimate, 4 oz. to 30 gal. of water. Formaldehyde was also tested and gave some measure of control, but was not as satisfactory as the corrosive sublimate treatment.

As the solution loses strength with repeated use, the authors recommend the adding of ⅜ oz. of corrosive sublimate after treating each 4 bu. and restoring the volume of water to the original 30 gal.

Streak disease of potato, W. A. Orton (*Phytopathology, 10 (1920), No. 2, pp. 97–100, pl. 1, fig. 1*).—The author places on record observations regarding a disease of potatoes designated as the streak disease.

This disease affects the foliage, attacks full-grown and otherwise normal, healthy plants, and frequently progresses so rapidly as to destroy them. Shortly after its appearance on the leaflets, the petiole will be found affected and slightly discolored by longitudinal streaks. The petiole later collapses, the leaf withers and hangs limp, or the petiole breaks at the point of attachment to the stem and hangs by a thread in a dead and dried condition. Marked varietal differences have been observed in regard to the occurrence of this disease, the nature of which is still in doubt.

The mosaic disease of spinach as characterized by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Jour. Amer. Chem. Soc., 42 (1920), No. 5, pp. 1061–1070*).—To data by True and others, as previously noted (E. S. R., 40, p. 450), the authors add the results of a study begun in April, 1918. These, as presented and interpreted, are considered to warrant the conclusions that spinach plants, especially their tops, when affected with mosaic disease have a smaller percentage of total nitrate, acid amid and mono and diamino nitrogen, and a somewhat larger percentage of ammonia than normal plants, nitrous acid being present only in diseased plants. This is considered due to the fact that denitrification takes place, nitrates being reduced to nitrites, which, reacting on the various nitrogenous compounds present, bring about elimination of nitrogen in a free state and in the form of ammonia. Little, if any, denitrification occurs in diseased spinach roots. Conditions with regard to peptid and protein nitrogen are apparently somewhat complicated.

In round figures, spinach nitrogen is made up of 55 per cent protein nitrogen, 4.5 per cent diamino nitrogen, 5.5 per cent monoamino nitrogen, and 6 per cent peptid nitrogen; more than 70 per cent of the nitrogenous compounds in spinach having direct nutritive value.

Root disease in cane and suggestions for its control [in South Africa], P. A. VAN DER BIJL (*Union So. Africa, Dept. Agr. Bul. 4 (1918), pp. 15, pls. 5*).—This pamphlet gives an account of work still in progress on a sugar cane root disease which is provisionally referred to a soil fungus, *Marasmius* sp. Evidence has been obtained of the agency in this connection of another fungus.

The fungus appears to be weakly parasitic. The main injury results from its smothering the buds, thus causing a poor stand of cane, also from its invasion of the roots and stunting the growth of the canes. Not all cases of invasion lead to notable injury, however.

Apparently the fungus is native, and is transmitted by contact with plant material, or in such material when diseased. Suggestions are offered regarding its control.

The mode of infection by smut in sugar cane, J. F. DASTUR (*Ann. Bot. [London], 34 (1920), No. 135, pp. 391–397, figs. 10*).—Inoculation experiments as here outlined are claimed to show that infection of sugar cane with smut (*Ustilago sacchari*) takes place through the buds only, the germinating sporidia penetrating the young, thin-walled scale hairs, but not the ends of the cuttings. A bud can produce a spore-bearing shoot within two months after infection. Diseased cuttings give rise to diseased shoots.

Chemical variations in yellow-striped cane, F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 77, 78*).—In a report on the investigational work in progress, it is stated that an investigation was made by E. D. Colón to determine what effect, if any, the yellow-stripe disease of sugar cane had on the chlorophyll of the leaves. Spectroscopic observations showed that the spectrum of alcoholic solutions of the chlorophyll of diseased and healthy cane did not differ in any respect, indicating that the nature of the pigment was not altered by the disease.

Another investigation was made to determine whether the yellow-stripe disease caused any inversion of the sucrose in the cane. The results obtained are held to show that the disease had no effect on the sucrose content of the cane, and that it is only when the stalk cracks as a result of the drying process induced by the disease that inversion occurs.

Investigation of dry rot in swedes, E. B. LEVY (*New Zeal. Jour. Agr., 19 (1919), No. 4, pp. 223–228*).—Trials of measures for control of swede dry rot were inaugurated in 1918 and carried out at four centers in Southland, where the disease is severe. The experimentation, including manurial, variety, and seed-origin trials, is reported in tabular form, with discussion of details.

In nearly every case the better the crops in an affected area, the more subject they were to the disease. Seed from different localities differed as regards susceptibility. Variety tests indicate that while none are immune, some exceed others in resistance, offering a start for the breeding of resistant strains.

Blossom drop of tomatoes, F. M. ROLFS (*Oklahoma Sta. Rpt. 1920, pp. 47–49*).—Studies were made of weather conditions, and particularly moisture factors, in connection with the setting of tomatoes in Oklahoma. Evidence has been secured which seems to indicate that moisture is an important factor in the setting of tomato fruit, and that straw mulch is an efficient conserver of soil moisture.

Notes are given on the attack of Fusarium on some of the plants and also the relative resistance of varieties to Fusarium diseases and attacks on fruit late in the season by a species of Phoma. Some injury due to *Septoria lycopersici* is also reported.

Infection experiments on tomatoes with Phytophthora terrestria and a hot-water treatment of the fruit, J. ROSENBAUM (*Phytopathology, 10 (1920), No. 2, pp. 101–105*).—As a result of studies made by the author it has been

found that an abundant moisture supply, preferably free water, in infected soil, is a necessary condition for producing an epidemic infection with *P. terrestria* on tomatoes. The addition of a 1:5,000 solution of copper sulphate to infected soil is said to prevent infection of green tomatoes when in contact with such soil. The immersion of green tomatoes in water at 60° C. for 1.5 minutes was found to prevent the spread of the buckeye rot where the infection was very recent and the fungus had not penetrated deeply into the tissues.

A bacterial leaf spot of velvet bean, F. A. Wolf (*Phytopathology, 10 (1920), No. 2, pp. 73–80, figs. 2*).—The author reports noticing a leaf spot of the Florida velvet bean near West Raleigh, N. C., in 1916. Since that time the disease has been observed to be more or less destructive in the same locality, and specimens have been procured of the disease in widely separated portions of the State. The disease is said to be restricted to the leaves, on which it first becomes apparent as translucent areas, turning at length to dark brown in color. The cause of the organism is said to be a bacterium and is described as a new species under the name *Aplanobacter stizolobii.* Inoculation experiments have shown that it has an incubation period of about four days, infection occurring through the stomata. The invasion at first is intercellular but later becomes intracellular, and only parenchyma tissues are involved.

Development of fruit buds, F. M. Rolfs (*Oklahoma Sta. Rpt. 1920, p. 49*).—In connection with a report of a study of the development of fruit buds, the author states that apple blotch (*Phyllosticta solitaria*) is particularly prevalent in Oklahoma, and that it matures its spores earlier than is usually supposed. Much winterkilling of fruit buds is reported in the State, and in most cases the killing was found to be due to excessive development of the buds during the fall. It is hoped that methods of treatment will be worked out so that fruit buds may enter the dormant period in a well-matured condition.

Cherry leaf spot or yellow leaf, G. H. Coons (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 93–96, figs. 2*).—The life history and effects of the fungus causing cherry leaf spot are popularly described. The author gives suggestions for the control of the disease, consisting of the turning under of all fallen leaves early in the spring, followed by spraying with either dilute lime sulphur or Bordeaux mixture, three applications to be given, the first when the petals fall, the second about three weeks later, and the third directly after the fruit is picked.

Phony peaches: A disease occurring in middle Georgia, D. C. Neal (*Phytopathology, 10 (1920), No. 2, pp. 106–109, pl. 1, fig. 1*).—A description is given of a disease of peaches which is said to occur in Georgia. The disease is characterized by the leaves being somewhat larger than normal and of a dark green color. Twigs of trees having this disease are particularly noticeable on account of their short, stubby growth, and as a result of the disease the entire head of the tree is reduced to a rather compact shape. The disease is believed to be one of the so-called physiological diseases.

The amount of fruit produced by trees attacked by this disease is said to be small. Field observations seem to indicate that trees which have reached the bearing age are more susceptible, although the disease has been found on seedlings which were in their sixth season's growth.

Brown rot of plums and cherries, C. W. Michel (*So. Dak. State Hort. Soc. Ann. Rpt., 14 (1917), pp. 186, 187*).—Brown rot, recognized as the most destructive disease of stone fruits, can be perfectly controlled by careful treatment, including destruction of diseased material and spraying with self-boiled lime sulphur. Three applications of this preparation are considered sufficient if a pressure not less than 200 lbs. is employed.

Lime-sulphur spray following Bordeaux (*New Zeal. Jour. Agr., 19 (1919), No. 6, pp. 371–374*).—Tests as to the alleged burning (russeting) due to the use of lime sulphur following Bordeaux mixture used to control black spot were carried out at two points.

At Arataki fruit on trees twice sprayed with Bordeaux mixture looked well in case of some varieties, while in others it appeared dull or slightly scorched. Foliage was normal on all trees but one treated with 6:4:50 Bordeaux at open-cluster and with 1:80 lime sulphur when the fruit had set, the fruit being practically clean and the yield normal.

At the Papanui orchard, lime sulphur following Bordeaux mixture did not reduce the crop. Black spot was kept well in check, and the foliage looked healthier than where Bordeaux mixture alone was used.

Fruit tree rots, E. Noffray (*Jour. Agr. Prat., n. ser., 32 (1919), No. 12, pp. 244–246*).—Two root rots, due respectively to *Dematophora necatrix* and *Armillaria mellea*, are discussed as to symptoms, effects, and treatments.

Winter injury of berries, J. L. Stahl and A. Frank (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 3, pp. 34–36, fig. 1*).—Popular descriptions are given of winter injury to the canes of berry plants. Some of the factors which induce a tendency toward injury by frost are mentioned, and suggestions are given for the proper maturity of canes to prevent winter injury.

Grape anthracnose, E. Noffray (*Jour. Agr. Prat., n. ser., 32 (1919), No. 39, p. 795*).—A brief discussion is given of grape anthracnose (*Gloeosporium ampelophagum*) and of means and conditions related to its control.

Citrus gummosis and a new preventive and curative remedy, M. S. Bertoni (*An. Cient. Paraguay, Ser. II, 1919, No. 5, pp. 408–421, figs. 2*).—Citrus gummosis, which has been associated with *Bacillus gummificans* and other factors, is said to cause severe and increasing loss throughout the La Plata Basin. It is stated that in shaded situations citrus is not attacked by gummosis, and that even after it appears it may be greatly checked by the use of artificial shade. This fact is considered to afford strong evidence in favor of the view that the cause or essential condition of citrus gummosis lies in faulty nutrition and physiological changes, due to lack of balance between the organic functions and particularly between water uptake and evaporation.

The relation of certain greenhouse pests to the transmission of a geranium leaf spot, P. Garman (*Maryland Sta. Bul. 239 (1920), pp. 57–80, figs. 7*).—The author reports that the rejection of a shipment of several thousand geranium plants resulted in their examination and discovery of severe insect stigmonose and a number of fungus troubles. Further investigations have shown that the principal fungus concerned in this disease, which is designated as circular spot, is *Cercospora brunkii.* Studies were made of this organism, and the possibility of the transmission of the disease by mites, red spiders, and white flies was investigated. Insects were found to play a very small part, if any, in the transmission of the disease, but it appears that the spreading of the circular spot is due to methods of watering. Control of the leaf spot may be obtained by applications of Bordeaux mixture. Good ventilation should be provided wherever possible and every precaution taken to prevent excessive humidity or dampness.

Brown bast [in Hevea] (*Pubs. Nederland.-Indisch Landb. Synd., 11 (1919), No. 11, pp. 83–98*).—A systematic review is given of Hevea brown bast, the causation of which has not been discovered, though it is suspected to be due to an organism.

Late seasonal production of aecia of Cronartium ribicola, H. H. York (*Phytopathology, 10 (1920), No. 2, p. 111*).—The author reports the observation

of freshly matured aecia of *C. ribicola* on a native white pine tree near Amery, Wis., September 16, 1919. The puzzling occurrences of this fungus on Ribes late in the season, which had been earlier apparently free from disease, may be explained by the presence of such late aecia.

On the biology of Fomes applanatus, J. H. WHITE (*Roy. Canad. Inst. Trans., 12 (1920), No. 2, pp. 133–174, pls. 6, figs. 2*).—*F. applanatus*, widely distributed and common in North America and Europe, causes decay of large quantities of wood annually, attacking practically all deciduous species and several coniferous tres, both living and dead. This fungus is said to have been now for the first time comprehensively studied. Investigations here noted have followed three main lines, viz, a study of the morphology and the ecology of *F. applanatus* and of its action on the host; a determination of the etiological relationships by culture methods, and a testing of the applicability of such methods to a study of the timber-destroying fungi; and an investigation of the possibility of finding criteria by which to distinguish parasitic action on wood from saprophytic action. Details are given of studies applied to the fungus on wood and in cultures.

F. applanatus has been shown to be a wound parasite, and in southern Ontario at least to be one of the commonest and most destructive of this type. The occurrence of wound gum and the multip'ication of tyloses in a band marking the advance of the wood-destroying fungus in a living tree is considered to furnish an unerring criterion for the recognition of the fungus as a parasite. An extensive bibliography is given.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The "one-letter" rule for generic names in zoology, W. L. MCATEE (*Amer. Nat., 55 (1921), No. 636, pp. 89–96*).

Notes on the occurrence of warts on cottontail rabbits, J. E. GUTHRIE (*Iowa Acad. Sci. Proc., 26 (1919), pp. 157–161, fig. 1*).—This note records the frequent occurrence of epithelial growths on the heads of cottontail rabbits in the western border counties of Iowa and in southern Nebraska.

The migratory bird treaty act (*U. S. Dept. Agr., Dept. Circ. 182 [1921], pp. 3*).—This is an extract from the charge delivered to the grand jury in the District Court of the United States for the Middle District of Alabama at Opelika, April 4, 1921, by Judge H. D. Clayton.

The crow in Michigan: Its status and methods of control, A. C. CONGER (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 108, 109*).—This is a brief summary of the status and methods of control of the crow in Michigan.

The status of Merriam's shrew (Sorex merriami), H. H. T. JACKSON (*Jour. Mammalogy, 2 (1921), No. 1, pp. 29–31, fig. 1*).

Observations on the nematode genus Nematodirus, with descriptions of new species, H. G. MAY (*U. S. Natl. Mus. Proc., 58 (1920), pp. 577–588, pls. 7*).—In the course of investigations of the species of Nematodirus, the author failed to find any clear differences between *N. filicollis* Rud. and *N. spathiger* Raill. Four new species were recognized and are described. A list is given of 20 references to the literature.

Studies on Myxosporidia.—A synopsis of genera and species of Myxosporidia, R. KUDO (*Ill. Biol. Monog., 5 (1919), No. 3–4, pp. 265, pls. 25*).—The author states that the total number of species of Myxosporidia reported to date and described in the present work, excluding 12 ambiguous forms, reaches 237, of which 125 are species which have been observed since 1910. Of these 63 species occur in North America. The genus Wardia of the family Ceratomyxidæ is erected, and 15 species are described as new.

The Myxosporidia are common parasites of fish in various parts of the world. A list showing their geographical distribution, a host list, and a bibliography of 10 pages are included.

The general anatomy and physiology of insects, C. HOULBERT (*Les Insectes; Anatomie et Physiologie Générales. Paris: Libr. Octave Doin, 1920, 2. ed., rev., pp. 374+[XVII], figs. 209*).—A second edition of this work (E. S. R., 24, p. 54) on the anatomy and physiology of insects, which includes a bibliography of 10 pages.

General treatise on entomology, T. MIYAKE (*Konchûgaku Hanron Jôkwan. Tokyo: Shokabo, 1919, vol. 2; rev. in Science, n. ser., 50 (1919), No. 1301, p. 527*).—This second volume of the work previously noted (E. S. R., 38, p. 357) includes a discussion of insects in relation to plants, animals, and man, with methods of general study, classification, and collection. A history of entomology in foreign countries and in the older days in Japan is also included. The review is by L. O. Howard.

Report of the division of entomology, F. SHERMAN and Z. P. METCALF (*North Carolina Sta. Rpt. 1920, pp. 39–45*).—Investigational work during the year is briefly considered by F. Sherman. This is followed by a report of the entomologist, Z. P. Metcalf, of the work carried on under the Hatch and Adams funds.

Experiments in the destruction of suckers in tobacco fields have shown that from 98 to more than 99 per cent of the flea bettles that were thus forced into hibernation before the middle of September died before the tobacco was up in the seed beds the next spring. On the other hand, in a few cases as many as 60 per cent of the beetles which fed on tobacco suckers until frost were able to live through the winter.

Report of the entomological department, C. E. SANBORN (*Oklahoma Sta. Rpt. 1920, pp. 31–46, figs. 17*).—Apicultural work is briefly reported upon, and some of the more important insect enemies of the season of garden, field, and horticultural crops and poultry are noted.

Annual report, division of entomology, E. G. SMYTH (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 83–89*).—Experiments in the artificial transmission of cane mottling disease were carried on during the year, in continuation of those of the previous year (E. S. R., 44 p. 159).

Of 266 experiments with insects that had previously fed upon mottled cane, 9 with chewing insects gave negative results. The other 257 tests were with sucking insects, and, of these, 9 gave positive inoculation with the cane mosaic. "Of the 9 plants, 2 became diseased following attack of the West Indian cane-fly (*Stenocranus saccharivorus* Westw.), 1 following attack of the yellow cane aphis (*Sipha flava* Forbes), and 1 following attack of the sugar-cane mealy bug, *Pseudococcus calceolariae* (?). Three plants became diseased in cages containing both cane-fly and yellow aphis, and 2 plants in a cage containing both cane red spider (*Oligonychus viridis* Banks) and the false mottling leafhopper (undetermined). In the case of the last five inoculations it was not possible to fasten the responsibility on a single species of insect. From these figures it is seen that only 3.5 per cent of the tests made with sucking insects were successful, which leaves a considerable margin of doubt in favor of the theory that these insects are the sole carriers of the disease, in view of their comparative scarcity in many cane fields where the disease has been spreading rapidly."

Plant quarantine work is also briefly reported upon.

Entomology (*Ontario Agr. Col. and Expt. Farm Ann. Rpt., 45 (1919), pp. 31–34*).—This is a brief report on the occurrence of the more important insects of the year and means for their control, together with a brief account of spraying experiments.

Fiftieth annual report of the Entomological Society of Ontario, 1919 (*Ent. Soc. Ontario Ann. Rpt., 50 (1919), pp. 136, figs. 20*).—This, the usual annual report (E. S. R., 42, p. 51), includes the following papers presented at the annual meeting: Reports on Insects of the Year: Division No. 3, Toronto District, by A. Cosens (pp. 13, 14), Division No. 4, Peterborough District, by F. J. A. Morris (pp. 14, 15), Division No. 5, Essex District, by J. W. Noble (p. 15); Entomological Progress in British Columbia, by R. C. Treherne (pp. 16–18); Results of Some Preliminary Experiments with Chloropicrin, by G. J. Spencer (pp. 18–21); Our Common Cercopidæ, by G. A. Moore (pp. 21–25); My Experience this Year in Dusting and Spraying (1919), by Father Leopold (pp. 25–30); Insect Outbreaks and their Causes, by J. D. Tothill (pp. 31–33); Further Notes on the Control of Pear Psylla, by W. A. Ross and W. Robinson (pp. 33–38); The Federal Plant Quarantine Act, by C. L. Marlatt (pp. 38–43); Hopkins' Bioclimatic Law, by W. Lochhead (pp. 43–49); Locusts in Manitoba, with Special Reference to the Outbreak in 1919, by N. Criddle (pp. 49–53); Life-history Notes on Some Species of Acrididæ (Orthoptera) found in British Columbia, by E. R. Buckell (pp. 53–61); One Year's Experiments in the Control of the Cabbage Maggot, by W. H. Brittain (pp. 61–68); The Control of the Cabbage Root Maggot in British Columbia, by R. C. Treherne and M. H. Ruhmann (pp. 68–70); Further Data on the Control of the Cabbage Root Maggot in the Ottawa District, by A. Gibson (pp. 71–73); Cabbage Maggot Control, by L. Caesar and H. C. Huckett (pp. 73–77); The Present Status of Mill-infesting Pests in Canada, by E. H. Strickland (pp. 77–80); Some Notes on the Life History of our Common June Beetles, by H. F. Hudson (pp. 81–83); Report of the Insects of the Year, Division No. 6, by H. F. Hudson (pp. 83, 84); The Strawberry Root Weevil in British Columbia, by W. Downes (pp. 84–88); The Strawberry Weevil, by W. A. Ross and C. H. Curran (pp. 88–95); Insects of the Season in Ontario, by W. A. Ross and L. Caesar (pp. 95–104); Remarks on the Ancestry of Insects and their Allies, by G. C. Crampton (pp. 105–110); Later Developments in the European Corn Borer Situation, by E. P. Felt (pp. 110, 111); and The Entomological Record, 1919, by A. Gibson and N. Criddle (pp. 112–134).

[Papers on insects and insect control] (*Min. Agr. [France], Ann. Serv. Épiphyties, 6 (1918), pp. 34–174, 228–280, 289–319, figs. 55*).—Papers here reported (E. S. R., 41, p. 59), which relate to economic entomology, include the following: Insect Enemies of the Fig Tree, by F. Picard (pp. 34–174), the special part of which deals with those which attack the wood and those which attack the foliage; A Chalcidid Injurious to the Almond Tree in the Syrian Region [*Eurytoma amygdali* End.], by P. Lesne (pp. 228–241); The Treatment of Tree Fruits with Arsenicals Alone and with Insecticides and Fungicides Combined, by P. Marchal (pp. 242–280); Locusts in the Southeast of France in 1918, by P. Vayssière (pp. 289–298); Use of the Trap Bait in Combating the Cochylis Moth, by L. Moreau and E. Vinet (pp. 299–312); and Experiments with Delayed Arsenical Treatments for the Control of the Eudemis Moth (*Polychrosis botrana* Schiff.), by F. Feytaud (pp. 313–319).

Report of the Imperial Entomological Conference (*Imp. Ent. Conf. [London] Rpt., 1920, pp. 19*).—This is the report of a conference held at London June 1 to 11, 1920.

Grasshoppers and related insects (*Maine Sta. Doc. 541 (1921), pp. 6*).—This circular briefly summarizes the methods of control of these insects, a more detailed account of which is given in Bulletin 296, previously noted (E. S. R., 45, p. 254).

The screw worm and the wool maggot, O. G. Babcock and D. H. Bennett (*Texas Sta. Circ. 27 (1921), pp. 3–15, figs. 7*).—This is a popular summary of information on the screw worm (pp. 3–14) and the black blow fly or wool maggot, *Phormia regina* Meig. (pp. 14, 15).

Insect injuries in relation to apple grading, B. B. Fulton (*New York State Sta. Bul. 475 (1920), pp. 3–42, pls. 4, figs. 19*).—In this bulletin the species of insects that attack apple fruits are described and grouped according to the character of the injuries they produce. A key is given for the identification of these species, which permits ready recognition of the typical malformations of the fruits. Methods for combating the individual insects are described. The bulletin includes colored plates of some apple insects controlled by spraying and injuries common to apples. Charts are given illustrating periods during which the insects are actively injurious to the fruit and the stages in the development of the buds and fruit when sprays should be applied.

Insect enemies of shade trees and ornamentals, G. A. Dean (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 151–171*).—This is a summary of information on the more important insect enemies of shade trees and ornamentals in Kansas.

[Insect pests of the oil palm] (*Bul. Imp. Inst. [London], 18 (1920), No. 2, pp. 237–240*).—This is a brief summary of information on the more important insect enemies of *Elaeis guineensis.*

Late developments in arsenical insecticides, R. A. Cooley (*Better Fruit, 15 (1920), No. 5, pp. 9, 10, 16*).—The author reports that crude white arsenic obtained from Montana smelters at a low cost has given quite satisfactory results when used in grasshopper control. It was also found that it could be used as a spray on potatoes for the control of the potato beetle without injuring the foliage, perhaps due in part to the short period of time that the arsenic was in the water, since, when sprayed on the vines, the water evaporated very quickly. The first experiment was with the refined white arsenic, and later the crude product was applied as a dust and the results were even better, due, it is thought, to the fineness of the crude product.

The action of chloropicrin on grain pests, A. Piutti and R. Bernardini (*Rend. Accad. Sci. Fis. e Mat. Napoli, 3. ser., 23 (1917), No. 4–6, pp. 51–53; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 8, p. 334*).—Chloropicrin has been found to be more effective against *Calandra granaria, Tenebroides mauritanicus, Læmophlœus ferrugineus,* and the larvae of *Sitotroga cerealella, Tinea granella,* and *Plodia americana* than is carbon bisulphid, carbon tetrachlorid, sulphurous anhydrid, hydrocyanic acid, etc.

Grasshopper control work in Iowa, H. E. Jaques (*Iowa Acad. Sci. Proc., 26 (1919), pp. 133–142, figs. 8*).—The author reports upon work with grasshoppers, the attacks by which during the summer of 1918 seemed to have been the most extensive of recent years.

Experiments conducted during the summer of 1919 showed that grasshoppers caught with a hopperdozer with either kerosene or gasoline as a killing agent may be dried even more successfully than those caught alive, and that in feed value they are in every way the equal of those caught without kerosene. A bushel of grasshoppers caught in the hopperdozer, when thoroughly drained, weighs 40 lbs. and contains about 85,340 individual insects. In drying the weight was reduced to about 31 per cent of the original weight, but they expanded enough in bulk to make a bushel weigh only 8 lbs. when thoroughly sun dried.

The locust in Argentina, F. Lahille (*Min. Agr. Lab. Zool., Buenos Aires, 1920, pp. 172, pls. 12, figs. 16; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 2, pp. 475, 476*).—This is an extended account of the locusts occurring in Argen-

tina, including *Schistocerca flavofasciata* DeG., *S. paranensis* Burm., *S. rustica* F. (*pallens* Scud.), and *S. cancellata* Serv.

Locusts and their control (*Bul. Imp. Inst.* [*London*], *18* (*1920*), *No. 2, pp. 256–270*).—This is a popular summary of information on the subject.

Thrips damaging tobacco (Anaphothrips striatus Osb.), W. W. Froggatt (*Agr. Gaz. N. S. Wales, 31* (*1920*), *No. 7, pp. 502–506, figs. 2*).—The author records injury by *A. striatus* to tobacco in the Tanworth and Gunnedah districts of New South Wales. The attack of the thrips upon the maturing leaves causes them to dry and results in a considerable reduction in the weight of the infested foliage. The frass deposited all over the surface of the infested leaves also damages the quality of the dried leaf.

The life cycle of aphids and coccids, E. M. Patch (*Maine Sta. Bul. 295* (*1920*), *pp. 221, 222*).—This is an abstract of the paper previously noted (E. S. R., 45, p. 251).

A descriptive catalogue of the scale insects (Coccidae) of Australia, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 25* (*1914*), *Nos. 2, pp. 127–136, pl. 1; 4, pp. 311–319, pl. 1; 7, pp. 599–610, pls. 2; 8, pp. 677–684, pl. 1; 10, pp. 875–882, pl. 1; 11, pp. 983–989, pl. 1; 26* (*1915*), *Nos. 5, pp. 411–423, pls. 4; 6, pp. 511–516, pl. 1; 7, pp. 603–615, pls. 3; 9, pp. 754–764, pls. 3; 12, pp. 1055–1064, pls. 2; 27* (*1916*), *Nos. 6, pp. 425–430, pls. 2; 8, pp. 568–578, pls. 2; 11, pp. 809–816, figs. 5; 12, pp. 883–888, fig. 1; 28* (*1917*), *Nos. 2, pp. 134–140, figs. 4; 7, pp. 505–514, figs. 6*).—This has been noted from another source (E. S. R., 42, p. 453).

The nondiaspine Coccidae of the Philippine Islands, with descriptions of apparently new species, H. Morrison (*Philippine Jour. Sci., 17* (*1920*), *No. 2, pp. 147–202, pl. 1, figs. 40*).—This paper includes descriptions of one new genus and five new species.

On the bionomics and development of Lygocerus testaceimanus Kieff. and L. cameroni Kieff. (Proctotrypoidea-Ceraphronidae), parasites of Aphidius (Braconidae), M. D. Haviland (*Quart. Jour. Micros. Sci.* [*London*], *n. ser., 65* (*1920*), *No. 257, pp. 101–127, figs. 18*).—"*L. testaceimanus* is a hyperparasite of *Aphis saliceti* Kalt., through the primary parasite *Aphidius salicis* Hal.; and *L. cameroni* is similarly a hyperparasite of *Macrosiphum urticae* Kalt., through the primary parasite *Aphidius ervi* Hal. The Aphidius is attacked immediately before or after metamorphosis, when lying within the empty skin of the aphis within which it is reared.

"The egg is laid, and post embryonic development takes place, outside the body of the host. The evidence points to the conclusion that there are four larval instars and three moults. The larvae differ in several particulars from those of the families of Proctotrypoidea previously described, and there is considerable difference in form between the early and later instars. During development, which lasts about six days, the larva devours its host, and then pupates within the skin of the aphis for a further period of two weeks. Two and possibly more, broods are reared in the season; and it is probable that the hyperparasite is a considerable check on the Aphidius in its control of plant-lice infestation.

"Lygocerus, though occasionally attacked by its own species, was never found to be parasitized by another hymenopteron. This immunity is probably due to the active movements with which the larva and pupa in the cocoon respond to external stimuli."

A bibliography of 27 titles is included.

Black fly on citrus trees, S. F. Ashby (*Jour. Jamaica Agr. Soc., 24* (*1920*), *Nos. 3, pp. 72–74; 6–7, pp. 182–184; abs. in Rev. Appl. Ent., 8* (*1920*), *Ser. A, No. 2, pp. 480, 481*).—A brief account is given of the occurrence and status of the black fly, or spiny citrus white fly (*Aleurocanthus woglumi*), in Jamaica.

Red and brown fungi appear to slowly follow and attack the pest, and the heavy early infestation is appreciably reduced as the fungi become established. It is said that at the lower elevations ant control is frequently 100 per cent efficient. In colonization work it is necessary to destroy the small black stinging ant by oil emulsion before the establishment of the beneficial ant can be successfully accomplished.

The pink bollworm in the West Indies, H. A. Ballou (*Agr. News [Barbados], 19 (1920), No. 487, pp. 410, 411*).—The pink bollworm was discovered in cotton fields in Montserrat on November 5, 1920, and in St. Kitts on November 15, and investigations have shown it to be well established on both islands. No infestation has been found in Antigua or Nevis. It is thought that the infestation originated on a steamer from Brazil, the cargo of which included some 50 tons of cotton seed from that country. This steamer is said to have called for cargo at St. Kitts, Montserrat, and Antigua in June.

The control of the codling moth in the Arkansas Valley fruit belt, G. A. Dean and W. R. Martin (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 89–102, figs. 6*).—This account is accompanied by charts which show the time and extent of the damage by the codling moth.

Spraying apples and pears for control of codling moth, T. D. Urbahns (*Calif. Dept. Agr. [Pamphlet], 1920, pp. 3*).—Directions are given for the application of insecticides for the control of the codling moth in California.

The corn ear worm, J. W. McColloch (*Canner, 52 (1921), No. 6, pp. 37–40*).—This is a paper presented before a meeting of the Western Canners' Association at Chicago, in November, 1920.

Biology and economic importance of Anastatus semiflavidus Gah., a recently described egg parasite of Hemileuca oliviae, D. J. Caffrey (*Jour. Agr. Research [U. S.], 21 (1921), No. 6, pp. 373–384, pl. 1, figs. 3*).—This parasite of the New Mexico range caterpillar, *H. oliviae* Ckll. (E. S. R., 23, p. 463) appears to have been reduced by some severe and unusual climatic condition to such an extent that its presence was not discovered prior to 1913. Since this time it has increased in numbers each year until it now exerts a powerful influence in the natural control of its host. The parasite has been found to be widely distributed in that part of northeastern New Mexico which was heavily infested by the range caterpillar.

Oviposition begins as soon as the eggs of its host are deposited or about the middle of September, and continues until the arrival of severe winter weather, which occurs at these high altitudes during late November or early December. Judging from numerous dissections of host eggs, it is probable that the parasite eggs which are deposited just before the beginning of cold weather hibernate in that stage, while the eggs which are deposited early in the season hatch and hibernate as partly developed larvae within their host.

The larval period of individuals observed was limited to about seven months, whereas other eggs in the same egg clusters were found to contain full-grown dormant larvae nearly two years later. Dissections of 1- and 2-year-old eggs collected in the field gave similar results, and established the fact that on some occasions the insect remains in a dormant larval state for at least two years.

The pupal period appears to be very short. Adults have been observed in the field from the early part of May until the first of December, the maximum emergence occurring during July and August.

"From a series of 49 cages started in September and October, 1914, a total of 383 adults were reared. These adults required a maximum of 449 days and a minimum of 226 days to complete their life cycle, the average

being 380 days. From a series of cages started in October, 1915, a total of 40 adults were reared. These adults required a maximum of 346 days and a minimum of 238 days to complete their life cycle, the average being 266 days. From a series of stock cages started the last week in September, 1914, adults were reared from the first week in the following May until March, 1917, a minimum of 7 months and a maximum of 30 months. It is evident that this prolonged life cycle was not due to the artificial cage conditions, because adults emerged from 1- and 2-year-old eggs collected in the field."

The methods of rearing in cages and the habits of the parasite are considered at some length. Adults of *A. semiflavidus* were also reared from eggs of *H. nevadensis* Stretch. Laboratory experiments demonstrated that adults emerging from *H. oliviae* eggs would breed in eggs of *H. nevadensis*. A study of the life history of *H. nevadensis* demonstrated that its life cycle and that of *H. oliviae* correlate very closely.

The life history and habits of two parasites of blowflies, A. M. ALTSON and H. M. LEFROY (*Zool. Soc. London Proc., 1920, III, pp. 195–243 figs. 20*).—"The breeding operations and accumulation of supplies of *Alysia manducator* Panz. and *Nasonia brevicornis* Ashm. commenced in July and ceased in December, 1919.

"*A. manducator* oviposits in the larvæ of several carrion-feeding Diptera. Only one parasite emerges from each host puparia. Over-parasitism kills the larva. The mean average of the life cycle is 52 days, and as short as 25. Both sexes are capable of sustained flight, and lived over a month in captivity. Average percentage of parasitism over three years was 43 per cent, observed by Graham-Smith [E. S. R., 42, p. 361]. Average contents of ovaries 366 eggs for 12 females.

"*N. brevicornis* oviposits in the puparia of several species of stercoral and carrion-feeding dipterous larvæ. From 1 to 62 individuals have been found in single puparia parasitized in captivity. The length of the life cycle ranges from 11 to 22.5 days in different countries. Only the female can fly, and then only very short distances, and can live while ovipositing from 4 to 6 weeks, but for a considerably less period without host puparia. The male remains near the vicinity of emergence, where its life is spent in fighting and mating. Average progeny in the case of five females, observed by Girault and Sanders [E. S. R., 23, p. 161] and McCarthy, was 113 per female, and affecting on the average only 16.4 hosts.

"Nasonia can act as an accidental secondary parasite upon *A. manducator* if and when puparia containing the latter are within its limited reach. Both parasites in their hibernating stage, i. e., full-grown larvæ, can successfully withstand over 6 weeks at 2° C. *A. manducator* appears to be a more important parasite as a natural control for the blowfly than *N. brevicornis*, which appears to be more effective as a natural control of Diptera which constantly breed in permanent refuse and garbage heaps, and where hosts would be within crawling distance, such as primarily the common house fly (*Musca domestica*)."

Hessian fly prevention: Entomological service to the Ohio farm bureaus, H. A. GOSSARD and T. H. PARKS (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 67–76*).—The authors report upon the preliminary work of 1919, and the result of the late-sowing campaign of these years, the methods of discovering the seeding date, and October egg laying. See also a previous note (E. S. R., 35, p. 899).

Dusting cotton for the control of the boll weevil, M. C. TANQUARY and H. J. REINHARD (*Texas Sta. Circ. 29 (1921), pp. 3–9, fig. 1*).—This is a report of experiments conducted during the season 1920, one with hand guns and two with a large traction duster.

The experiments with the traction duster show that weevil infestation may be reduced from a high to a very low percentage by dusting with calcium arsenate if applied with efficient machinery. Four applications were made between July 17 and August 4 in one of the experiments and four between July 19 and Aug. 9 in the other. In the two dusted plats in the first of the two experiments the percentage of infestation was reduced from 67 to 15.2 per cent and from 24.6 to 11 per cent, respectively; while the infestation in the check plats increased from 59.6 to 75.2 per cent in one, decreased from 52 to 47.6 per cent in another, and increased from 19.2 to 56.6 per cent in the third. In the dusted plat in the second experiment infestation was reduced from 41.2 to 16.4 per cent, while the check plats showed increases of from 58.4 to 73.2 per cent and from 34.2 to 63.8 per cent, respectively. It is pointed out that the dusting should be commenced before a high percentage of infestation is reached, or when the infestation is from 10 to 20 per cent.

Find good remedy for cucumber beetle (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, p. 92*).—Tests made at the Marietta field laboratory show a mixture composed of 1 part of calcium arsenate and 20 parts of land plaster, applied with a shaker, to be superior to 25 other materials and compounds tested for control of the striped cucumber beetle. Applications should be commenced as soon as young plants come up, followed by 2 applications per week during fair weather, 10 to 12 applications per season usually being required.

The New Zealand grass grub.—Some notes on its control, A. H. Cockayne (*New Zeal. Jour. Agr., 21 (1920), No. 1, pp. 1–5, fig. 1*).—These notes relate to the control of *Odontria zealandica*.

New serphidoid, cynipoid, and chalcidoid Hymenoptera, A. A. Girault (*U. S. Nat. Mus. Proc., 58 (1920), No. 2332, pp. 177–216*).—Among the new forms here described that are of economic importance are the following: *Hadronotus ajax*, reared from eggs of the squash bug at Baton Rouge, La., and known to occur in Missouri and Texas; *Paraceraptrocerus africanus*, reared from a Ceroplastes on *Elytropappus rhinoceratis*, Cape of Good Hope, Africa; *Achrysopophagus io* and *A. rex*, both reared from the citrus mealy bug on bamboo, Manila, P. I.; *Blastothrix brittanica*, from *Lecanium capreae*, Cheshire, Eng.; *Achrysocharis camilli*, reared from an Agromyza on alfalfa, Elk Point, S. Dak.; *Eurytoma phoebus*, reared from *Elymus canadensis* May, Elk Point, S. Dak.; *Eurytoma poloni*, reared from the larvae of an Agromyza in bean roots, Los Baños, Luzon, P. I., reference to which was made by Otanes y Quesales (E. S. R., 40, p. 457); *Eurytoma illinoisensis*, reared from Elymus, Taber, S. Dak.; *Decatoma flamminneiventris*, parasitic upon *Prodoxus decipiens*, Fort Collins, Colo.; *Paratrigonogastra stella*, reared from Agromyza larva on bean roots, Los Baños, Luzon, P. I.; *Tripolycystus cryptognathae*, reared from the pupa of *Cryptognatha nodiceps* Mskl., Trinidad; *Spalangia muscidarum texensis*, a parasite of the stable fly at Dallas, Tex.; and *Terobia flora*, reared from fig, Cocoanut Grove, Fla. The genera erected are Paraceraptrocerus and Tyndarichoides.

North American ichneumon flies, new and described, with taxonomic and nomenclatorial notes, R. A. Cushman (*U. S. Natl. Mus. Proc., 58 (1920), pp. 251–292, fig. 1*).—This paper includes corrections to Viereck's Type Species of the Genera of Ichneumon Flies (E. S. R., 30, p. 661), and extensive additions to the author's revision of the tribe Cremastini (E. S. R., 38, p. 660), together with descriptions of one new genus, one new subgenus, and 23 new species of Ichneumonidae, and three new species of Braconidae. Among the new species known to be of economic importance are *Spilocryptus propodeum* from *Polychrosis viteana* Clemens, North East, Pa.; *Angitia galleriae*, reared from the bee moth at Lansing, Mich.; *Bassus acrobasidis*, reared from *Acro-*

basis caryaevorella on pecan at Brownwood, Tex.; and *Orgilus gelechiaevora* from *Gelechia trialbamaculella* Chambers at Whitesbog, N. J. The genus Oligotmema and the subgenus Areolpristomerus are erected.

Life-history studies of three jointworm parasites, W. J. PHILLIPS and F. W. POOS (*Jour. Agr. Research [U. S.], 21 (1921), No. 6, pp. 405–426, pls. 6, figs. 16*).—Life-history studies of three of the more important parasites of *Harmolita tritici* Fitch, conducted at the laboratory at Charlottesville, Va., during the years 1917–1919, are reported upon. The species are *Ditropinotus aureoviridis* Cwfd. and *Homoporus chalcidiphagus* Walsh and Riley, both primary parasites, and *Eupelmus allynii* French, a primary and secondary parasite. The distribution of the first two mentioned is similar to that of the jointworm, while *E. allynii* is commonly found wherever the Hessian fly and the majority of the species of Harmolita are found, which includes practically all of the wheat-growing regions of the United States.

D. aureoviridis, first described in 1907, apparently prefers *H. tritici* and *H. vaginicola* Doa., and has been reared by the authors in cell slides on *H. elymicola* P. and E. and *H. grandis* Riley. It breeds freely upon the larvae of *Eurytoma* spp. in the field and in breeding cages, and upon one occasion an egg was deposited in a Harmolita cell upon a pupa of *D. aureoviridis*. Its eggs are deposited in the gall-like cells of *H. tritici* external to the host larva, the period of incubation of 199 eggs in cell slides varying from 1 to 5.5, with an average of 3 days. The largest number of eggs secured from a single female was 18 during a period of 12 days. Larvae reared in glass cells became full grown in from 6 to 24 days, with an average for 137 of 11 days. The prepupal period varied from 1 to 6, with an average of 2 days. The pupal stage varied from 8 to 15, with an average for 8 individuals of 10 days. The winter is passed as full-grown larvae in the jointworm cells in old wheat stubble. In Virginia the adults of the first generation begin to emerge about the first week in June and the second generation about the first week in July. Two complete and a partial third generation were reared in glass cells during 1918 and 1919, and apparently a partial third from the field in 1919.

H. chalcidiphagus, next to *D. aureoviridis*, is the most important parasite of *H. tritici* in Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, and Missouri, while in the Atlantic States *Eurytoma* sp. is probably of greater importance. *H. chalcidiphagus*, first described in 1869, is one of the oldest recorded parasites of the jointworm. It has been reared from field collections of *H. tritici*, *H. caginicola*, *H. secalis*, *H. hordei* Har., *H. elymicola*, and *H. atlantica*. The length of the egg stage varied from 1 to 4.5 days, with an average for 71 eggs observed of about 2.5 days. The average number of eggs deposited by 5 females was 31.8 in an average period of 15.2 days. Observations of 42 larvae in glass cells show from 5 to 25 days, with an average of about 11 days, to be required for their development during the summer. The winter is passed as full-grown larvae in the cells of the jointworm. Observations of 37 individuals showed a variation of from 1 to 6 days in the prepupal stage, with an average of about 2 days. The length of the pupal stage for 64 individuals varied from 9 to 10 days. Five complete generations were reared at the laboratory in cell slides from May to September, 1918.

E. allynii was first described in 1882, and its life history was recorded by Packard in 1916 (E. S. R., 35, p. 466). The author considers it to rank about fourth in importance in the list of parasites of *H. tritici*. It apparently breeds as freely as a secondary parasite in jointworm cells as upon jointworms themselves under both field and cage conditions. It has been found breeding as a secondary parasite on *D. aureoviridis*, *H. chalcidiphagus*, and *Eurytoma* sp.

both in cages and in the field. It is recorded from *H. tritici*, *H. vaginicola*, *H. maculata* Hwd., *H. elymicola*, *H. elymivora*, *H. atlantica*, *H. albomaculata* Ashm., *H. grandis grandis*, and from what is thought to be a new species which forms galls in *Panicum clandestinum*, also probably from *H. occidentalis* P. and E. and *H. hesperus* P. and E. The incubation period of 79 eggs varied from 1 to 4.5 days, with an average of 2.4 days. From 7 to 12 with an average of 9 days were required for the development of 32 larvae reared in glass cells in 1918. They were found to breed freely in cell slides through five generations during the season of 1918. The prepupal stage varied from 1 to 3 with an average of 1.7 days for 17 individuals, and the pupal stage from 7 to 33 with an average of 21 days for 62 individuals. One female observed lived 52 days and oviposited over a period of 32 days. Four generations were reared in glass cell slides during the breeding season of 1918, starting with females that emerged from material collected the previous fall and kept under as nearly normal conditions as possible.

"Judging from the observations recorded herewith and from the field observations of the season of 1919, it is quite clear why the parasites do not quickly gain complete control of the wheat jointworm. The writers have found that as the parasites become more abundant hyperparasitism increases greatly. Some of the parasites that are primary only, when present in small numbers, become both primary and secondary as they become more abundant."

The auditory sense of the honeybee, N. E. McIndoo (*Abs. in Anat. Rec., 20 (1921), No. 2, pp. 182, 183*).

The olfactory sense of the honeybee as related to pollination, K. von Frisch (*Zool. Jahrb., Abt. Allg. Zool. u. Physiol. Tiere, 37 (1919), No. 1–2, pp. 238, figs. 14*).—This is an extended report of investigations. It includes a bibliography of 105 titles, and author and subject indexes.

Sixty years of beekeeping in California, J. E. Pleasants (*Calif. Cult., 56 (1921), No. 5, p. 133*).—This is an account by one of the pioneer beekeepers in California.

The Dadant system of beekeeping, C. P. Dadant (*Hamilton, Ill.: Amer. Bee Jour., 1920, pp. X+115, figs. 59*).—The chapters of this work relate to early experiments and natural history, size of hives, drones and drone production, the Dadant hive, handling bees, apiaries, apiary management in the spring, swarm prevention and supering, extracting the honey, nomadic beekeeping, fall management, wintering, diseases of bees, and enemies of bees.

Preliminary notes on the value of winter protection for bees, J. H. Merrill (*Kans. State Hort. Soc. Bien. Rpt., 35 (1918–19), pp. 119–129, figs. 5*).—This is a report upon work conducted with a view to securing data showing the necessity for winter protection.

Six hives containing a known amount of honey and a known number of bees were placed on scales and daily readings taken of all changes in weight. Three of these hives were sheltered by a windbreak while the others were not. Each set of three consisted of one 1-story hive, one 2-story hive, and one packed hive. In addition to making daily readings of the changes in weights, a general weighing was made at the beginning of the honey flow in the spring to determine the number of bees in the colonies on that date.

"These observations show that the 2-story hive is preferable to the 1-story hive, and the packed hive is much to be preferred over the unpacked hive. It was also shown that a windbreak is very essential, especially to colonies which have no other form of winter protection. The effect of a severe winter was found to be less injurious to the overwintering of bees than an open winter. Colonies which are packed for the winter consume more stores, owing to the fact that more stores are necessary, due to increased brood rearing."

How to control American foulbrood, H. F. WILSON (*Wisconsin Sta. Bul. 333 (1921), pp. 21, figs. 8*).—This is a summary of information, giving directions for combating this disease of the honeybee.

FOODS—HUMAN NUTRITION.

The microbiology and microanalysis of foods, A SCHNEIDER (*Philadelphia: P. Blakiston's Son & Co., 1920, pp. X+262, figs. 131*).—As indicated by the title, this volume is concerned with the theoretical and practical aspects of the microbiology of foods. The first five chapters are devoted to a discussion of the decomposition changes occurring in foods, the principal groups of organisms concerned in food spoilage, and the kinds of food most and least likely to undergo microbial deterioration. The next five chapters contain general and special directions for the microanalytical investigation of food products, proposed food ratings based upon the author's experience in the examination of food products, and the legal standards of purity for animal and vegetable products, salt, and alimentary pastes. A diet table, compiled by G. T. Sipes, and a list of 14 reference books complete the volume.

The book for all households, or the art of preserving animal and vegetable substances for many years, N. APPERT, trans. by K. G. BITTING (*Chicago: Glass Container Assoc. Amer., 1920, pp. 18+XV+113, figs. 7*).—This is a translation of the original description by Appert of his process of preserving foods through sterilization by heat in closed vessels, the process which is the foundation of the modern methods of canning.

Although developed more than 100 years ago, the directions read surprisingly like those of the modern method of cold pack canning. The general principle, as described in the author's words, is "to enclose in the bottle or jar the substances that one wishes to preserve; to cork these different vessels with the greatest care, because success depends chiefly on the closing; to submit these substances thus enclosed to the action of boiling water in a water bath for more or less time according to their nature and in the manner that I shall indicate for each kind of food; and to remove the bottles from the water bath at the time prescribed."

Among the suggestions and precautions are to be noted the poor economy in using cheap corks (the bottles were sealed by forcing well-softened corks into the neck of the bottle with a mallet); the necessity of using fresh, well selected material and of grading it according to size; and the indispensability of speed and cleanliness in the preparation of the materials. In the special directions for individual vegetables the process of blanching is generally prescribed as shown by the following directions for artichokes: "After having removed all the unnecessary leaves, and pared them, they are plunged into boiling water, and then into cold water; after they have drained, they are put in wide-mouthed bottles, closed, etc., and then in the water bath to receive an hour's boiling, etc."

Of interest and possible present-day application is the use of cloth bags for holding the separate jars during sterilization. The bags, which are lowered into the water bath by string handles, are said not only to protect the jars against breakage, but in the event of breakage from defective glass, the fragments of glass remain in the bags.

In the preserving of fruits the author recommends using no sugar but sweetening the finished product when served with a grape sirup prepared by boiling down grape juice and treating it with chalk or washed ashes to neutralize its acidity. The resulting sirup is considered to preserve the aroma

and acidity of the fruits better than sugar. Jams and conserves are prepared by boiling down the sterilized fruit with the sirup.

A brief sketch of the life of Appert and translations of the correspondence at the time of the adoption of this method in France are included.

The effect of certain agents on the development of some molds, K. G. Bitting ([*Chicago*]: *Glass Container Assoc. Amer., 1920, pp. 177, figs. 179*).—This is the report of an extensive series of microscopic studies of the effect of various agents found naturally in or frequently added to foods upon the growth of three molds, *Penicillium expansum*, *Alternaria solani*, and *Oidium lactis*, all of which were isolated from tomato products and grown under uniform conditions in tomato bouillon, to which were added the various materials to be tested. The data reported include a set of tables giving the number of days required for germination and the macroscopic developmental features of the growths in the flasks at intervals of 24 hours for the first 5 days, and another set which records the average size and the microscopical appearance of the conidia of the Penicillium after germination. The descriptions are supplemented by microphotographs of the three molds under the varying conditions of the experiment.

The oldest and most generally used preservatives, salt, sugar, and potassium nitrate, produced plasmolysis, resulting finally in the complete arrest of growth from starvation but not in the death of the organism. Most of the spices tested were innocuous, causing neither retardation nor abnormal effects. Allspice, cinnamon, and cloves produced varying degrees of enlargement with disorganization of the protoplasm and walls. Mustard produced starvation and disorganization of the protoplasm and in the Penicillium a tendency to form fruity heads almost directly from the hyphae developed from the germinated spore. This was noted even when minute amounts of the mustard were used.

Citric, lactic, and malic acids in amounts up to 6 per cent caused only a slight retardation in development, tartaric a somewhat greater retardation, and acetic, benzoic, boric, butyric, and salicylic acids and their sodium salts a complete disorganization of both protoplasm and walls.

Metallic salts produced similar though not so extreme results. Swelling by the lesser amounts and stunting by the greater were produced by carbolic and the mineral acids, creosote, mercuric chlorid, and the alkaloids, the last two also causing disorganization of the protoplasm. Alcohol retarded development and produced swelling, distortion, and hardening, and in some cases disorganization.

An extensive list of literature references is appended.

The nutritive value of some preserved foods, J. Athanasiu, G. Pamfil, and P. Stavresco (*Compt. Rend. Soc. Biol.* [*Paris*], *83 (1920), No. 14, pp. 568–571, fig. 1*).—This is a condensed report of the results of digestion experiments, conducted on 10 young men, using various rations employed in the Rumanian Army. These included the customary barracks ration of fresh meat, vegetables, and bread; canned meat and biscuits (galettes); canned white beans and galettes; roast meat and bread; vegetable soup and bread; the barracks ration with polenta in place of bread; vegetable soup and polenta; cold storage meat and bread; and white cheese and galettes. Data are presented on the protein content of the different rations, the coefficients of digestibility of the protein of the different rations, the urinary nitrogen, the content of starch, the content of salts, the salts eliminated, and the chlorids eliminated. The principal conclusions drawn are that the proteins of white beans and corn are more difficult to digest than those of bread and meat, that the starch of the white beans and corn are more difficult to digest than those of bread and other vegetables, that canned meat is more difficult to digest than boiled

or roasted meat, and that the nitrogen balance is lowest on feeding with white beans and with polenta in place of bread.

The chemical properties of food fats of different biological values, S. ROSENBAUM (*Biochem. Ztschr., 109 (1920), pp. 271–278*).—In an effort to determine a possible relationship between the composition of food fats and their biological value, determinations of phosphatids and sterols were made in egg yolk fat, cod liver oil, butter fat, human milk fat, lard, and hazel nut oil. No quantitative differences could be found which could be correlated with differences in biological value.

Experiments on leavening bread, J. GROSSFELD (*Chem. Ztg., 44 (1920), No. 143, pp. 889, 890*).—As the result of various attempts to obtain a substitute for yeast which would have satisfactory leavening powers without using up the nutrients in the flour as does yeast, and which would not give the bread the objectionable taste often resulting from the use of soda, the author suggests a combination of equal parts of sodium bicarbonate and calcium carbonate with sour milk as a source of lactic acid. The sour milk is used instead of sweet milk or water to form the dough, and to the dough is added during kneading a mixture of equal parts of the two salts in the proportion of 14 gm. to 1 liter of the sour milk. The reactions involved consist in the evolution of CO_2 by the action of the lactic acid on the sodium carbonate and the removal of the excess of acid by union with the calcium carbonate, forming calcium lactate which does not have the disagreeable taste imparted to the bread by excess of sodium carbonate.

Note on the influence of diet on the energy expenditure in work, J. B. ORR and J. P. KINLOCH (*Jour. Roy. Army Med. Corps, 36 (1921), No. 2, pp. 81–86*).—To determine whether the amount of energy expended per unit of work is influenced by the nature of the preceding meal, the resting metabolism and the energy expenditure on a constant amount of work were determined upon a single subject in the postabsorptive state immediately before a meal (15 hours after the last meal) and after an interval of 90 minutes following meals in which protein, fat, and carbohydrate, respectively, predominated. The test meals consisted of 50 gm. of oatmeal, with additions of 100 gm. plasmon (about 80 per cent casein), 80 gm. of cane sugar, and 35 gm. of margarin for the high protein, sugar, and fat diets, respectively. The protein and carbohydrate meals furnished about 540 calories and the fat about 480 calories each. The work consisted in marching along a corridor at the rate of 100 yds. a minute. The energy expenditure was measured by indirect calorimetry. The increase in net expenditure on work in calories per minute was found to be for the protein meals 3.86 in the post absorptive state and 3.96 after meals for carbohydrate 3.71 and 3.65, and for fat 3.77 and 3.77, respectively.

These results show that the expenditure of energy per unit of work performed is influenced by the nature of the preceding meal. Following the high protein meal, the increase due to work is greater and following a high carbohydrate meal less than in the preceding post absorptive state, while following a high fat meal the extra energy expenditure due to food is equal to that due to work. While it is suggested that the difference in results obtained in these three cases is due to a difference in the mechanism of stimulation involved by the ingestion of protein, carbohydrate, and fat, it is pointed out the results are not comparable with those obtained at a different period relative to ingestion of food or after a longer period of work.

Artificial nutrition and vitamins, F. RÖHMANN (*Über Künstliche Ernährung und Vitamine. Berlin: Borntraeger Bros., 1916, pp. V+150, pls. 2, figs. 19*).—This monograph, which is one of the series of biochemical studies edited by A. Kanitz, is of historic interest in that the author as late as 1916 refused

to believe in the existence of vitamins. In addition to reports of original investigations which are considered to prove that mice can be successfully nourished on a diet of purified foodstuffs, a rather extensive digest of vitamin literature is presented, together with arguments attempting to disprove the vitamin theory in each case. The explanation given throughout is that the materials furnishing the so-called vitamins were instead furnishing supplementary materials (Ergänzungsstoffe) for the incomplete proteins of the purified food material. As illustration the proteins of polished rice are considered incomplete, while the silver skin contains "Ergänzungsstoffe," evidently assumed to be of the nature of unknown amino acids, which, when combined with the protein of the polished rice, render it complete. An extensive list of literature references is given as footnotes.

Nutrition experiments (*Oklahoma Sta. Rpt. 1920, p. 31*).—When young rats were fed various rations, the lot receiving wheat, potatoes, and milk made better gains the first 30 days than any lot not fed milk except the lot fed cheese alone. During the next 30 days, the lot receiving cheese showed the largest gain in weight, followed by the oatless group and the wheatless group.

In another test, rats receiving potatoes, salt pork, and water, supplemented by wheat bread and oatmeal, made an average gain in weight in 30 days of 20.4 gm., while a lot receiving corn meal as a supplement gained 14.8 gm. Corresponding lots also receiving milk gained 44 and 44.5 gm.

Lower vegetative forms and the accessory factors of growth, P. Goy (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 4, pp. 242–244*).—From a study, the details of which are not presented, of the food requirements of a number of unicellular organisms including *Saccharomyces cerevisiae, Mucor mucedo, Aspergillus niger, Penicillium glaucum, Bacillus megathorium,* and several other organisms, the author states that these lower vegetable forms do not require for their development any organic substances of the nature of the so-called vitamins, but that their proliferation is remarkably stimulated by the addition of a small amount of an inorganic medium in which has formerly been grown either an identical or different species. The organic substance conferring this property has been extracted by means of ether in a crystallizable form from a culture of Mucor. It does not show its growth-promoting property until it has been heated at from 85 to 90° C. and loses it at 168 to 170° dry heat, but is not affected by heating in the autoclave for 1.5 hours at 130°. The substance is further described as containing carbon, possessing acid properties, melting at 175°, not precipitating with phosphotungstic acid, presenting none of the characteristics of an amino acid, and showing no trace of phosphorus or nitrogen. Similar results have been obtained from extracts of vegetable tissues and lemon and orange juice.

The properties upon which the conclusion is drawn that the new substance is not of the nature of the hitherto recognized vitamins are summarized as the need of previous heating to render the substance active, nondestruction by moist heat even at a high temperature, and the presence of the substance in the grains of polished rice. On the other hand the small amount of material necessary, its destruction by radium and by boiling in alkaline solution, its resistance to ultraviolet light, and its truly accessory character point to its being a growth-promoting substance not indispensable to the life of unicellular organisms but singularly efficacious for their proliferation.

The effects of yeast vitamin water-soluble B on plant cell masses and on biocolloids, D. T. MacDougal (*Soc. Expt. Biol. and Med. Proc., 18 (1920), No. 3, pp. 85–87*).—The action of the water-soluble vitamin in yeast upon the hydration of various plant materials is reported. Sections of the materials

were placed in slender dishes into which the solutions were poured. The swelling in a vitamin solution prepared by diluting 1 part of yeast in 1,000 of distilled water was compared with that in distilled water alone, using the auxograph in taking the measurements. Various colloidal preparations were also hydrated in the vitamin solution, and the swellings at 15° C., relative to that in water taken as 100 are reported.

The vitamin solution at an H-ion concentration of pH=5.25 caused hydration in excess of that in water with agar, agar and soap, agar-gelatin, agar-gelatin and salts in various proportions, and gelatin, and lessened hydration in agar and salts, agar-gelatin and soap, gelatin and salts, and gelatin and soaps. The vitamin solution caused excess hydration with mature fruits, pith and joints of plants, and dried cell masses of roots and joints of Opuntia, and lessened hydration in young tubers of potato and roots of corn. Increased hydration took place in root-tips of orange seedlings and of strawberry plants. It is suggested that the accelerating action of this vitamin on such unlike colloids may be due to the action of various components inert to each other, and which affect but one of the main components of the biocolloids of the mixtures or of living matter.

Food accessory factors in relation to the teeth and bones, P. R. Howe (*Commonhealth [Mass. Dept. Pub. Health]*, *7 (1920), No. 4, pp. 228–234, figs. 5*).—The author reports that he has obtained marked changes in the teeth, the alveolar processes, and the jaws of guinea pigs by prolonged feeding on vitamin-deficient diets, consisting of rolled oats supplemented by 25 cc. of fat-free milk daily. The desire being to produce a chronic condition, the animals were carefully watched, and when difficulty in the use of their legs or difficulty in eating was observed, orange juice or a small amount of green food was given until a decided improvement in condition was noted, when the animals were again put back on the vitamin-deficient diet.

In experiments continuing for some time the teeth, particularly in young animals, were regularly decalcified, and distinct cavity formation appeared in some cases. Irregular arrangements of the teeth were common, and many loosened and dropped out. Other decalcified areas occurred in the maxillary bones and in the bones of the head and ribs and leg bones. By alternating deficient and normal diets distinct marking of the enamel of the teeth resulted. These observations confirm the work of Mellanby on young dogs (E. S. R., 41, p. 364) and Zilva and Wells on guinea pigs (E. S. R., 41, p. 471) as to the effect of vitamin-deficient diets on the teeth, and give further emphasis to the belief that tooth destruction is one of the first signs of lack of vitamins in the diet.

The antiscorbutic property of raw, dried, and cooked apples and bananas, M. H. Givens, H. B. McClugage, and E. G. Van Horne (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, pp. 140, 141*).—The authors report that a per diem dose of 10 gm. of raw applies or bananas will protect a guinea pig against scurvy for 3 months, while protection is not secured by an equivalent amount of these fruits cooked at 100° C. for 15 minutes, or dried at 55 to 60°, or dried at 55 to 60° and cooked for 15 minutes at 100°.

The destructive effect of oxidation on antiscorbutic vitamin, A. F. Hess and L. J. Unger (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, p. 143*).—As evidence that the antiscorbutic vitamin is destroyed by oxidation, the authors cite the following experiments:

Guinea pigs developed scurvy in from 3 to 4 weeks when fed oats+80 cc. daily of raw milk which had been treated by allowing it to stand over night in the incubator after adding normal hydrogen peroxid solution in the proportion of 4 cc. to 1 liter of the milk. Orange juice added to the dietary

served as a protective or curative agent. It is also noted that orange juice subjected to oxygen for a short period and milk or tomato juice which had been shaken lost some of this vitamin.

"As foodstuffs undergo oxidative processes frequently in the course of various manipulations, no doubt this factor plays an important rôle. This action probably explains the differences in the antiscorbutic potency of foodstuffs which have been treated in apparently similar ways, for example, of milk which has been heated in open pans or in hermetically sealed bottles."

Regeneration of the testicle in the pigeon deprived of vitamins, P. Portier (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1339–1341*).—In continuation of the study of the effect of deprivation of vitamins on the testicles of pigeons (E. S. R., 43, p. 369), the author reports that birds whose right testicles have been partially removed while on a vitamin-free diet are able to regenerate the testicle to normal size and activity on being fed for some time on a vitamin-rich diet. It is thought that the successive lack and abundance of vitamins play an important rôle in the phenomenon, as the regeneration of the function of the testicle took place in the winter when in the normal pigeon the organ would be in its seasonal involution.

The mechanism of the lesions and the physiological symptoms presented by animals suffering from deficiency diseases, H. Bierry, P. Portier, and L. Randoin-Fandard (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 19, pp. 845–847*).—The authors attempt to establish a causal relationship among the different pathological changes observed in cases of avitaminosis, including hypertrophy of the adrenals, atrophy of the majority of the other organs, and lowering of the temperature preceding death.

In interpreting these facts three phases of avitaminosis are noted, as follows: In the first phase, where no symptoms are evident, the animal is consuming its vitamin reserves. In the second phase the animal reacts by hypertrophy of the adrenals and hypersecretion of adrenalin. This results in sclerotic lesions which start in the vesicular system and branch out into the parenchyma. At the same time that the living cells absorbed by the regions of sclerosis furnish the organisms with vitamins, the field of metabolism is restricted more and more. During the third and last phase the adrenal glands become incapable of furnishing the organism with a sufficient quantity of adrenalin, and a marked lowering of the temperature results.

Observations on beriberi among the Chinese in France, A. R. Leggate (*Edinb. Med. Jour., n. ser., 24 (1920), pp. 32–36*).—Observations on 269 cases of beriberi in the Chinese general hospital in France in 1917 are reported which present striking evidence of the intimate associaton of berberi with a diet of polished rice.

Scurvy in North Russia, J. D. Comrie (*Edinb. Med. Jour., n. ser., 24 (1920), pp. 207–215, pl. 1*).—This is an account of the epidemic of scurvy in North Russia previously noted from a report by Stevenson (E. S. R., 44, p. 262).

The possible pathogenicity of Bacillus botulinus, R. B. Edmondson, L. T. Giltner, and C. Thom (*Arch. Int. Med., 26 (1920), No. 3, pp. 357–366*).—In six series of experiments, involving from 3 to 6 guinea pigs each, typical botulism was induced in every case where heated spores of the Boise strain were injected subcutaneously with small amounts (from 0.5 to 1 cc.) of a 2 per cent $CaCl_2$ solution. All but 2 of the control animals receiving spores only died of botulism, but after a somewhat longer interval. The deaths occurred in from 3 to 6 days when the spores and salt were injected at the same time, and somewhat later if an interval occurred between the two injections. The Nevin strain gave almost negative results, only 1 out of the 4 animals dying. In several of the

cases living virulent bacilli were isolated from the local lesions at the site of injection.

Toxin-free spores of both the Boise and Nevin strains were fed to guinea pigs in small and large doses. With the Boise strain small doses of the heated spores produced no effect, and large doses caused botulism. With the Nevin strain 1 only of the 7 animals died of botulism.

These results are thought to indicate a limited and irregular pathogenicity of the organism itself, and point to the necessity of destroying all foods suspected of containing *B. botulinus* instead of salvaging them through heat.

ANIMAL PRODUCTION.

The internal secretion from the point of view of general biology, J. Strohl (*Rev. Gén. Sci., 32 (1921), No. 9, pp. 262–273*).—This is a critical review, with bibliography, of recent work on the influence of the endocrine glands on body development, growth, secondary sexual characters, etc., from the standpoint of the biological processes involved.

Influencing the growth of horny tissue (hair, nails, epidermis) by specific feeding, N. Zuntz (*Deut. Med. Wchnschr., 46 (1920), No. 6, pp. 145, 146*).—The author reports that the feeding of hydrolyzed keratin (proprietary preparations) increased the thickness and weight of wool in sheep and hair in men.

Digestibility of fodders, J. C. Brunnich and V. S. Rawson (*Queensland Agr. Jour., 15 (1921), Nos. 5, pp. 195–198; 6, pp. 235–239*).—The authors fed four wethers during 12 feeding periods of 12 days each and determined the digestion coefficients tabulated below:

Composition and digestibility of Australian feeding stuffs.

Feed.	Composition.					Digestibility (sheep).					Starch value.
	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract	
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Alfalfa hay	80.96	15.95	1.40	25.40	38.21	71.5	80.4	47.1	65.0	73.3	39.73
Bush hay—poor	78.21	2.95	.77	34.55	39.94	55.3	15.5	33.5	62.8	52.9	23.42
Mitchell grass hay	76.86	3.63	1.04	42.45	29.74	47.5	17.5	39.6	60.5	32.8	13.75
Corn and millet silage	27.90	1.44	.59	9.77	16.10	60.1	22.9	60.9	61.0	63.2	12.53
Wheat bran	84.29	14.26	4.48	9.84	55.71	73.6	80.1	59.7	37.0	79.6	48.86
Shorts (pollard)	86.40	14.70	4.26	5.31	62.13	77.3	78.9	74.1	40.5	80.2	68.12
Corn meal	85.28	8.57	3.65	2.03	71.03	81.1	59.9	84.1	55.1	84.3	71.84
Coarse dried blood	82.98	78.75	1.88	.....	2.35	62.8	60.8	100.0	.....	100.0	50.60
Fine blood meal	80.77	71.40	3.39	.....	5.98	88.0	89.0	89.9	.....	75.9	68.19

Comparisons are made throughout with results obtained in Germany and in the United States. The digestibility of the crude fiber of feeds grown in Australia was found relatively high, due, it is suggested, to the rapid growth plants make in that country. The coefficients for protein and fat tend to be lower than those determined elsewhere, and in connection with the lower digestibility of the proteins it is noted that Hawkesworth (E. S. R., 44, p. 268) states that the nitrogen content of Australian wool is about 2 per cent lower than that of English wool.

Studies of lactic silage based on the physiology of microorganisms, C. Gorini (*Clin. Vet. Rass. Polizia Sanit. e Ig. [Milan], 42 (1919), No. 6, pp. 171–185*).—The author reports that the presence of sodium chlorid in mixed cultures of butyric acid and lactic acid bacteria tends to reduce the activity of the former. Low incubation temperature (30° C.) had a similar effect.

The use of these facts to suppress butyric fermentation in silage and cheese is recommended.

Inspection of feeding stuffs, A. W. CLARK ET AL. (*New York State Sta. Bul. 469 (1919), pp. 3–319*).—This is a report on samples of feeding stuffs collected by the New York Commissioner of Agriculture during 1919. The protein, fat, and fiber content, the ingredients identified, and in the case of animal by-products the phosphoric acid content of the following materials are tabulated: Alfalfa meal, barley feed, barley mixed feed, barley middlings with hulls, brewers' dried grains, buckwheat mixed feed, cocoa shell meal, coconut oil meal, corn bran, corn gluten meal, corn gluten feed, maltose process gluten feed, corn feed meal, hominy feed, yellow hominy feed, cottonseed meal, cottonseed feed, distillers' dried grains, malt sprouts, dried yeast grains, dried beet pulp, linseed meal, linseed meal and screenings oil feed, oat hulls, oat meal by-product, peanut oil meal, peanut oil feed, velvet bean feed, wheat bran with screenings, wheat middlings with screenings, red dog, wheat mixed feed, wheat screenings, wheat and corn products, wheat and rye products, tankage, meat scrap, meat and bone scrap, beef cracklings, and various proprietary compounded chop, molasses, stock and poultry feeds, and calf meals. The sugar content of samples of feeding molasses is also included.

Bulls on the forest ranges, W. C. BARNES (*Producer, 3 (1921), No. 2, pp. 5–9, figs. 3*).—The author states that special rules have been widely adopted requiring the exclusive use of purebred bulls of a recognized beef breed in grazing areas of the National Forests. These rules are promulgated and enforced by the Forest Service of the U. S. Department of Agriculture whenever requested by the advisory board of a live-stock association representing a majority of the grazing users of the area in question. Over 450 associations are now cooperating with the Forest Service in this work. The bulls are selected and owned by the association, which allots them to permittees, prorating the costs according to the number of cattle grazed. The author has observed a marked improvement of range cattle with the development of this movement, and notes that cowmen in the open ranges have been impressed by the results and have in many States secured legislation forbidding the use of other than purebred bulls on the public domain.

Wintering and summer fattening of steers in North Carolina, F. W. FARLEY, F. T. PEDEN, and R. S. CURTIS (*U. S. Dept. Agr. Bul. 954 (1921), pp. 18, figs. 6*).—This bulletin is a record of three years' experiments, beginning with the winter of 1916–17, to study the influence of methods of winter feeding on the gains of steers fattened on grass the following summer. The work was done in cooperation with the North Carolina Experiment Station, and continues the earlier experiments reported in Bulletin 628 (E. S. R., 38, p. 870).

From 17 to 40 yearling steers were fed in each lot. The period of winter feeding averaged 126 days, beginning about December 12 each year, while the summer pasture season averaged 140 days. The lots fed mixed hay averaged in the three years a winter ration of 11 lbs., lost 50 lbs. per head during the winter, and made a net gain of 287 lbs. for the 266 days. The lots fed corn silage (27 lbs. per head daily) made a loss of 40 lbs. during the winter, and a net gain of 296 lbs. The lots fed silage, stover, and hay consumed 15.2 lbs. of silage and 6.1 lbs. of dry roughage per head daily during the winter, losing 78 lbs., but making a net gain of 262 lbs. The lots fed on winter pasture (cut-over timberland) with mixed hay or corn stover and straw during brief periods when snow covered the ground lost 29 lbs. during the winter and made a net gain of 304 lbs. The lot fed stover, hay, and straw (one year only) consumed 10 lbs. of feed per head daily during the winter, lost 64 lbs. in that time, and made a net gain of 283 lbs.

It is estimated that the cost of feeding these steers during the four winter months averaged about half of the cost for a year. The use of winter pasture was found very economical, and directions are given for the establishment of such pastures.

Cattle feeding investigations, W. L. BLIZZARD (*Oklahoma Sta. Rpt. 1920, pp. 23, 24*).—A group of heifers (two Herefords, two Shorthorns, and one Angus) fed an average ration of 20 lbs. of kafir silage, 1 lb. of wheat straw, and 0.5 lb. of cottonseed meal made an average daily gain of 0.233 lb. per head in 90 days, beginning January 15, 1919. A similar lot fed 3 lbs. of alfalfa hay in place of the cottonseed meal gained 0.281 lb. per head per day.

Cattle feeding, F. A. HAYS (*Wyoming Sta. Rpt. 1920, p. 127*).—Four lots of 9 grade Hereford steers were fed 84 days in a comparison of home-grown feeds for wintering steers. The feeds given in the respective lots and the average daily gain per head were as follows: Native hay alone 0.91 lb., alfalfa hay alone 0.75 lb., native hay (half feed) and sunflower silage (full feed) 1.26 lbs., and native hay (half feed) and oat-and-pea silage (full feed) 1.25 lbs. Oat-and-pea silage with a half feed of alfalfa hay proved more satisfactory than alfalfa hay for heifers in the breeding herd.

Cattle feeding experiments, W. G. R. PATERSON (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 35–55*).—This is the report of four steer-feeding experiments conducted by the West of Scotland Agricultural College.

It was found that a no-grain ration of straw, swedes, rye grass, and clover hay produced gains that could be considered satisfactory during a time of feed shortage, as in the winter of 1917–18, when the experiments were begun. The feeding of concentrates—in this case crushed oats and cottonseed cake—resulted in a much more economical utilization of the farm roughages. It was also found that whitefish meal of good quality fed with crushed oats produced slightly better gains than cottonseed cake or peanut cake similarly fed.

Fleshing thin cows, R. H. WILLIAMS ET AL. (*Arizona Sta. Rpt. 1920, p. 451*).—Twenty-one old, thin, and weak range cows were divided into three lots and fed at the Cochise Dry Farm for 12 weeks, until they had acquired sufficient flesh for slaughtering. The lot making the best gains (2.99 lbs. per head daily) consumed an average ration of 60.42 lbs. of silage, 2.83 lbs. of cottonseed meal, and 2.64 lbs. of alfalfa hay. The lot consuming 66.86 lbs. of silage and 2.86 lbs. of cottonseed meal per head daily gained at the rate of 2.32 lbs. per day, while the lot receiving silage, cottonseed meal, and dry pasture made intermediate gains.

The modern Shorthorn, J. CAMERON (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 101–121, figs. 6*).—The author discusses the changes in Shorthorn type since the last decade of the nineteenth century.

Tests of crossing European cattle with the zebu, 'T HOEN (*Cultura, 31 (1919), No. 374, pp. 369–374, pls. 3*).—This is an account of some of the attempts to secure desirable cattle in the Dutch East Indies by crossing zebus with imported cattle from Europe and Australia. Cows of the Nellore breed of zebu were used principally in these crosses. They give from 8 to 10 liters of milk per day, testing 4.5 to 5 per cent butter fat. Milk yield but not fat percentage is improved by crossing, and the crossbred steers are of large size and valuable for draft purposes. In India, it is stated, crosses between Ayrshire bulls and Montgomery zebus give about 15 liters of milk, whereas Montgomery cows average 8 or 10.

Oxford Down sheep, R. GRAHAM (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 122–126, figs. 3*).—A brief statement of the status of the breed in Scotland.

Suffolk sheep, E. M. PRENTICE (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 127–136, figs. 3*).—This article deals with the raising of Suffolk rams in Scotland and their use on crossbred ewes.

Studies in the variation and correlation of fleeces from range sheep, J. A. HILL (*Wyoming Sta. Bul. 127 (1921), pp. 37–52, fig. 1*).—The author presents data showing the variability in the weight of fleeces of six Wyoming range flocks, and points out the economy of culling ewes producing light-weight fleeces. As evidence in favor of the view that sheep tend to produce fleeces of characteristic type throughout life, data are cited from a flock of 29 pure-bred Rambouillet wethers taken from the range at the time of first shearing and used in a 3-year feeding experiment at the station. In weight of clean wool there was a coefficient of correlation of 0.51 ± 0.09 between the fleeces produced on the range and the average of the three following years in the feed lot. The correlation between the first year in the feed lot and the two following years was 0.70 ± 0.07. Since there was an association (as measured by Yule's coefficient) between length of staple and weight of fleece in another flock of Rambouillets, it is concluded that fine wool sheep at least can be satisfactorily culled by estimating the length of the staple on the living animal and discarding the short-wooled individuals.

Studies on digestibility of sunflower silage fed to sheep, J. SOTOLA (*Washington Sta. Bul. 161 (1921), pp. 3–12, figs. 4*).—Details are reported of a digestion trial previously noted from Bulletin 158 (E. S. R., 45, p. 269). After a 14-day preliminary period on sunflower silage, 2 wether lambs were continued on the feed during a 10-day collection period. The average digestibility coefficients were as follows: Crude protein 58.3, ether extract 82.4, crude fiber 38.4, and nitrogen-free extract 58.2. The digestibility coefficients of one lamb were systematically higher than those of the other.

Sheep feeding, F. A. HAYS (*Wyoming Sta. Rpt. 1920, pp. 127, 128*).—In a briefly reported test of native feeds for fattening lambs, oat-and-pea silage was found more efficient than sunflower silage. Cottonseed meal as a supplement to native hay gave greater gains and better finish than old process linseed meal.

Sorghums or corn for fattening lambs, J. M. JONES (*Breeder's Gaz., 80 (1921), No. 1, pp. 13, 14*).—As a repetition of the experiment reported in Texas Station Bulletin 269 (E. S. R., 45, p. 69), 7 lots of 50-lb. lambs were fed for 90 days during the winter of 1920–21. Each lamb received an average daily ration of 0.877 lb. of grain, 0.156 lb. of cottonseed meal, and 1.477 lbs. of alfalfa hay. The grains (all ground) fed to the different lots and the average daily gain per lamb were as follows: Corn (as a check), 0.312 lb.; milo, 0.314 lb.; milo heads, 0.311 lb.; feterita, 0.312 lb.; feterita heads, 0.288 lb.; kafir, 0.321 lb.; and kafir heads, 0.283 lb. A table gives the proximate analyses of the grains fed in this and the preceding test.

A method for obtaining uncontaminated specimens of urine from the billy goat, with some notes upon the normal metabolism of this animal, R. A. PETERS (*Biochem. Jour., 14 (1920), No. 6, pp. 697–708, figs. 6*).—The author describes a bag and harness for collecting separate samples of feces and urine from goats, and reports physical and chemical determinations of the urine of goats fed experimental rations.

The H-ion concentration of the urine was found to change with the acidity of the ration. After several days in a pen on a grass ration the urine usually had a pH value between 5 and 6. After two or three days' feed of good clover hay the pH rose and remained constant at about 8.5, although the titratable alkalinity showed large daily variations. The feeding of hydrochloric acid increased the H-ion concentration, and the feeding of sodium bicarbonate low-

ered it. A 48-hour fast increased the acidity of the urine, the maximum H-ion concentration occurring several days after feeding was resumed.

As in carnivora, there was a tendency for ammonia nitrogen to appear in the urine when the urine was acid.

Goat raising in British Columbia (*Brit. Columbia Dept. Agr. Bul. 64 (1921), 3. ed., pp. 37, figs. 24*).—This is a treatise on the management of milch goats and Angora goats, with particular reference to conditions in British Columbia. It is estimated that there are 5,000 goats in the Province.

Effect of ration on the development of pigs, C. O. SWANSON (*Jour. Agr. Research [U. S.], 21 (1921), No. 5, pp. 279–341, figs. 22*).—The author reports data collected in five experiments at the Kansas Experiment Station, in each of which a group of young pigs were fed, one lot on corn alone, one on corn and ash, and other lots on corn and a nitrogenous supplement designed to supply the deficiencies of corn in protein or ash. Usually three pigs were fed in each lot, and at the beginning of each experiment one or two pigs of the same age and weight as the experimental pigs were slaughtered to determine the initial chemical composition. At the end of the experiment a representative pig in each lot was slaughtered and the chemical composition of the carcass studied.

In the annexed table information is assembled as to the character of the several rations in the five main experiments, the protein and energy content of the feed consumed by each pig, and the nutrients stored by each pig. The author does not give the duration of the experiments nor the initial weight of the pigs, but all the pigs in any one experiment were of the same age and practically the same weight.

Influence of supplements to a corn ration on the storage of nutrients in the bodies of pigs.

Initial age of pigs.	Lot number.	Supplements to corn.	Protein ingested.		Energy ingested.	Final weight (empty).[1]	Dry matter stored.	Protein stored.	Fat stored.	Energy stored.
			From corn.	From supplement.						
Mos.			*Pounds.*	*Pounds.*	*Therms.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Therms.*
4½	1	None	42.6	.....	827	141	58.5	6.3	51.0	231
	2	Bone ash	36.1	.....	701	123	46.8	5.7	39.8	182
	3	Black blood albumen	106.0	129.2	2,308	378	229.6	26.3	199.8	908
	4	Black blood albumen plus bone ash	118.2	142.2	2,570	389	244.2	24.3	215.0	970
3½	6	None	22.5	.....	390	63	(2)	(2)	6.6	30
	7	Synthetic ash	14.4	.....	250	46	(2)	(2)	−2.9	−13
	8	Protein-free milk	8.4	.8	176	28	(2)	(2)	−6.2	−27
	9	Milk protein	90.5	89.4	1,746	319	184.4	27.3	153.3	710
4	13	None	41.9	.....	707	105	44.1	4.9	38.9	176
	14	Synthetic ash	31.7	.....	536	86	31.0	4.6	26.0	121
	15	Protein-free milk	37.2	3.2	735	127	60.7	5.4	53.9	242
	16	Casein	84.6	66.6	1,558	283	150.0	20.2	126.6	582
	17	Milk albumin	59.0	6.7	1,012	181	100.2	14.1	84.9	391
	18	Milk protein	66.6	8.0	1,140	210	119.7	15.7	102.4	469
2	21	None	27.2	.....	449	63	26.6	3.8	22.1	102
	22	Casein	65.7	50.7	1,200	211	119.2	21.8	94.0	445
	23	Corn germ	31.1	21.5	813	140	65.7	13.4	50.5	242
	26	Milk albumin	77.0	46.3	1,387	245	138.8	24.3	110.2	519
	29	Casein	55.2	5.6	922	140	75.7	10.3	64.0	294
2¼	30	None	13.0	.....	224	29	(2)	(2)	−.6	−1
	31	Synthetic ash	12.4	.....	213	34	(2)	(2)	1.4	7
	32	Ash-free blood protein	22.3	23.6	427	72	31.5	7.2	23.5	114
	33	Ash-free blood protein plus synthetic ash	39.3	41.7	753	157	82.8	18.2	61.0	286
	34	Starch, casein, ash	[3] 25.6	21.8	825	159	78.2	16.8	58.3	282
	35	Casein, synthetic ash	47.4	80.7	1,021	200	106.7	22.9	78.8	382
	36	.....do	51.0	20.8	932	196	103.2	21.5	77.4	373
	37	.....do	53.1	25.8	980	192	109.1	21.4	83.1	397

[1] Live weight less contents of alimentary tract and bladder.
[2] Loss or very slight storage.
[3] Including the protein from starch.

When milk products were fed, material from 3 lbs. of milk was usually given for each pound of corn. In lot 36 half this amount of casein was offered, and in 26 the amount of albumin fed with 1 lb. of corn was equal to the casein in 3 lbs. of milk. In lot 37 the proportion of casein was gradually decreased, and in lots 18 and 29 the milk products were given every seventh day only. For lot 34 the supplements were combined to give the same nutritive ratio as corn. The black blood albumen was a commercial preparation and contained 81 per cent protein. The ash-free blood protein was prepared in the laboratory and contained 95 per cent protein and 1.01 per cent ash.

Five of the pigs (lots 6, 7, 8, 30, 31) were virtually starved on a corn ration without protein supplement. The other pigs on such a ration (lots 1, 2, 13, 14, 15, and 21) put on fat; in these pigs the consumption of protein per pound stored ranged from 8.62 to 6.32 lbs., but the ratio of total dry matter stored to protein consumed averaged about 1.1. From 4.45 to 3.04 therms of food energy were required by these 6 pigs for the storage of 1 therm; lots 23, 29, and 32 also fell within this range in energy utilization. The 13 other pigs recorded in the table all required less than 3 therms for the storage of 1 therm and this without much regard to the amount and source of the supplemental protein.

The most economical utilization of food proteins for protein storage occurred in lot 34, the consumption-storage ratio being 2.85 despite the wide nutritive ratio. The consumption-storage ratio for protein in lots 36 and 37 (moderate relative intake of milk proteins) was 3.34 and 3.7, respectively. In all cases, except lot 34, where the consumption of milk proteins was relatively high (lots 9, 16, 22, 26, and 35) the utilization of the protein for protein storage was poorer, the consumption-storage ratios varying from 7.49 to 5.08. With a small proportion of ingested milk protein (lots 17, 18, and 29) this ratio varied from 5.93 to 4.65.

In addition to the pigs whose records appear in the table, 3 others, 1 each from lots 1, 7, and 8, were continued for nearly 3 years on the experimental low-protein corn rations. In a 1,060-day feeding period the lot 1 pig increased in weight from 54 to 596 lbs. In the first 600 days a weight of only 135 lbs. was attained and in this period there was consumed 12.24 lbs. of protein per pound of protein stored and 8.23 therms of energy per therm stored. For the last 460 days the consumption-storage ratio of this animal for protein was 5.15 and for energy 2.93. The lot 7 pig increased from 42 to 394 lbs. and the lot 8 pig from 47 to 375 lbs. in the 923 days during which they were fed. At the end of the first 400 days they weighed only 60 and 64 lbs., respectively, and in this period their respective consumption-storage ratios for protein were 17.61 and 18.88, while the ratios for energy were 19.31 and 18.33. In the last 500 days these two pigs consumed, respectively, 5.37 and 5.96 lbs. of protein per pound stored and 3.28 and 3.11 therms of energy per therm stored.

The tabulated data include also proximate analyses of the slaughtered pigs and the weights of the lungs, heart, liver, and kidneys. The pigs that made restricted growth (final weight less than 100 lbs.) were characterized by a low fat and a high moisture content, while in the bodies of pigs that attained a weight above 225 lbs., including the hogs fed for long periods, the fat exceeded the moisture. For the intermediate weights the percentages of moisture and fat were substantially equal when the corn was supplemented by both protein and ash, but the fat content was higher than the moisture when corn alone was fed or corn plus either protein or ash. From the slaughter data it is concluded that the size of the internal organs is directly proportional to the amount of protein in the body.

Swine feeding investigations, C. P. THOMPSON (*Oklahoma Sta. Rpt. 1920, pp. 24, 25*).—In a 50-day comparison of methods of preparing barley, three lots of five 140-lb. hogs were given barley and tankage in the proportion 12:1. When the barley was fed whole and dry, the daily gain averaged 1.07 lbs. per head and 5.82 lbs. of feed were consumed per pound of gain. When the whole barley was fed wet, the gain was 1.14 lbs. and the feed consumed per pound of gain 5.5 lbs. When the barley was ground and fed dry, the gain was 1.5 lbs. and the consumption per pound of gain 4.78 lbs. Two other lots were fed barley and tankage by the free-choice system. With whole barley the gain was 0.9 lb. and the hogs consumed 6.7 lbs. of barley and 1.2 lbs. of tankage per pound of gain. When the barley was ground, the daily gain was 1.39 lbs. and the hogs consumed 4.7 lbs. of barley and 0.86 lb. of tankage per pound of gain.

Rations for pigs, J. W. WILSON and A. H. KUHLMAN (*South Dakota Sta. Bul. 192 (1921), pp. 302–316, figs. 4*).—Part 1 of this bulletin reports an experiment in hogging-off corn involving a comparison of protein supplements. There were four lots of 5 pigs each, varying in weight from 98 to 163 lbs., and the experiment lasted 45 days. The lot receiving no supplement gained 1.58 lbs. per head daily. With linseed meal the gains averaged 1.73 lbs. and with tankage 2.21 lbs. The lot having access to rape pasture in addition to the cornfield gained at the rate of 1.75 lbs. The weights and gains of the individual pigs are tabulated.

Part 2 is a detailed report of an experiment previously noted from the 1920 Report (E. S. R., 44, p. 673). Chemical analyses by B. A. Dunbar of the fish meal and tankage fed in this experiment are included.

Sorghum in intensive pig feeding, A. GOUIN (*Compt. Rend. Acad. Agr. France, 7 (1921), No. 27, pp. 588–592*).—The author reports pronounced success with a ration of sorghum and skim milk for fattening young pigs. The gains were more rapid than when peanut cake or palm-kernel cake was fed in conjunction with skim milk.

The pig industry, A. MANSELL (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 137–151, figs. 14*).—This article consists of brief descriptions of British breeds, including some unfamiliar or recently established breeds, such as the Lincolnshire Curly-coated, the Cumberland, the Wessex Saddleback, and the Gloucestershire Old Spots.

The American breeds of poultry, F. L. PLATT (*Chicago: Amer. Poultry Jour., 1921, pp. 256, figs. 98*).—This volume deals with the history and description of the breeds of poultry belonging to the American class. Discussions of three new varieties—the Blue Plymouth Rock, the Rhode Island White, and the Black Jersey Giant—are included.

Successful poultry raising, A. W. FOLEY (*Alberta Dept. Agr. Poultry Bul. 3 (1921), 4. ed., pp. 76, figs. 57*).—This is a discussion of the opportunity for poultry raising in Alberta, with descriptions of poultry houses and directions for the management of commercial plants, the management of the flock, fattening, marketing, feeding for winter egg production, and preventing diseases. Notes on turkeys, ducks, and geese are included.

Practical methods of watering layers, G. R. SHOUP (*Washington Sta. West. Wash. Sta. Bimo. Bul., 9 (1921), No. 3, pp. 38–41, figs. 2*).—Methods for watering laying hens inside the house are briefly described and illustrated.

Culling conveniences, W. A. LIPPINCOTT and N. L. HARRIS (*Kans. Agr. Col. Ext. Circ. 21 (1921), pp. [8], figs. 6*).—A catching coop for use in culling a flock of chickens is described and diagrammatically illustrated.

Some experiments in the preservation of eggs, N. PASSERINI (*Bol. Soc. Ital. Studio Aliment., 1 (1919), No. 1–3, pp. 23–30*).—In the author's experi-

ments fresh eggs, carefully washed, were rubbed lightly with lard containing 1 per cent of salicylic acid and kept in a cool dry place. At the end of 231 days they were still fresh. Unwrapped eggs suffered a loss in weight of 5 per cent in this time, while eggs that had been wrapped in oiled paper lost only 3 per cent. The albumen became fluid.

Eggs also remained fresh and in good condition for 14 months in aqueous solutions of lime made from statuary marble. With poorer grades of lime containing impurities, particularly alkaline hydroxids, the eggs tasted of lye. Attempts at preserving eggs dry after heat sterilization at 60° C. (140° F.) or exposure to ether vapor were not successful.

DAIRY FARMING—DAIRYING.

Inheritance in crosses of dairy and beef breeds of cattle, II, III, J. W. GOWEN (*Jour. Heredity, 11 (1920), Nos. 7, pp. 300–316, figs. 11; 8, pp. 365–376, figs. 8; abs. in Maine Sta. Bul. 295 (1920), pp. 217–221*).—These two reports on the crossbred cattle breeding work at the Maine Station continue a paper previously noted (E. S. R., 40, p. 73).

II. *On the transmission of milk yield to the first generation.*—Data are presented in graphical form showing the corrected milk yields and the changes in milk flow with advance in lactation of 12 crossbred cows, together with similar data for each dam and the assumed potential characteristics of the milk yield of each sire. The records are corrected to a 2-year-old basis by methods developed in a series of papers from the station (E. S. R., 44, p. 675). In the case of the Jersey bull and one of the Holstein bulls, the sire's productivity is taken as the average of the corrected records of his pure-bred daughters. Since no records were available for the pure-bred daughters of the second Holstein bull, the lactation curve of the pure-bred daughters of the first is used for both. The milking qualities of the Aberdeen-Angus bull are accepted provisionally as those of a herd of pure-bred Angus cows for which records were available. Only the first 8 months of a lactation were used as a basis of comparison, and the degree of resemblance of a crossbred to one or the other parent was determined by finding the ratio of the difference between high parent and crossbred to the difference between crossbred and low parent. The crossbreds include three Angus×Guernsey, two each of Jersey×Angus, Jersey×Holstein, and Holstein×Guernsey, and one each of Angus×Jersey, Angus×Ayrshire, and Holstein×Angus.

One of the Jersey×Holstein daughters resembled her Jersey parent more closely than her Holstein parent, but in all the other cases the milk yields of the daughters resembled more or less the yields of the high-producing parent, and it is concluded that there is an imperfect dominance of high milk yield.

III. *Transmission of butter-fat percentage to the first generation.*—The corrected percentages of fat in the milk produced by the 12 crossbred cows considered in the preceding paper are presented graphically, together with the fat percentages of the dams and the assumed fat percentages of the sires determined by methods similar to those used in determining milk yield. In general there was a tendency for the fat percentage to resemble that of the low-testing parent, and no evidence was found of sex-linked inheritance.

[Feeding experiment with dairy stock], W. S. CUNNINGHAM and R. N. DAVIS (*Arizona Sta. Rpt. 1920, pp. 465–467*).—In a brief experiment with Holstein and Jersey cows, it was found that chopped cane fodder could be substituted for the hay in a silage (25 lbs.) and alfalfa (15 lbs.) ration without

a serious reduction in the milk flow provided wheat bran and cottonseed meal (the grain mixture used) were fed in the proportion 1:2 instead of 5:1.

In a study of homemade and proprietary calf meals, normal growth was obtained with calves given whole milk alone for two months and then gradually transferred to a gruel made from a finely ground mixture of rolled barley, milo, wheat bran, alfalfa meal, linseed meal, and bone meal. The gradual replacement of whole milk after a week or 10 days by another mixture containing blood meal and a large proportion of corn meal, but no barley or milo, was not successful. The calves scoured badly, due it is thought to the coarseness of the feed. The work with proprietary calf meals indicated that these preparations have a value as a partial substitute for milk in the case of very young calves, since they are much more finely ground than is usually possible on the farm.

Further investigations of the biology of the lactic acid bacteria, C. GORINI (*Centbl. Bakt. [etc.], 2. Abt., 53 (1921), No. 13–14, pp. 284–297*).—This is a review of recent investigations, particularly those published by the author during the war. The topics discussed include the acid hydrolysis of milk proteins by lactic acid bacteria, the resistance of these organisms to heat, the microflora of the udder, spore-forming species, and the use of lactic acid bacteria in cheese making and silage making.

Investigations of an acid- and rennet-producing bacillus (Bacillus coagulans n. sp.), A. E. SANDELIN (*Centl. Bakbt. [etc.], 2. Abt., 49 (1919), No. 5–6, pp. 115–130*).—*B. coagulans* was isolated from decomposed cream in Sweden. It is a spore-forming, ciliated rod and a facultative anaerobe. It was found to coagulate slightly acid milk in a characteristic fashion, the coagulum being peptonized with the formation of peptones and amino compounds. In the fermentation of lactose and dextrose it forms acetic and succinic, but not lactic or oxalic, acids. It also ferments fructose, galactose, and maltose, but not saccharose, arabinose, or mannite. The organism also seemed to attack milk fat.

The accuracy of bacterial counts from milk samples, R. S. BREED and W. A. STOCKING, JR. (*Jour. Dairy Sci., 4 (1921), No. 1, pp. 39–72*).—A summary of material published in Technical Bulletin 75 of the New York State Experiment Station (E. S. R., 43, p. 680).

[Studies in the pasteurization of bottled milk and the manufacture of ice cream], A. C. BAER (*Oklahoma Sta. Rpt. 1920, pp. 30, 31*).—In a study of the in-bottle method of pasteurization, the author found that the cream line was affected by heating above 147° F. and by holding at 145° for 45 minutes. The prolonged holding also imparted a cooked flavor. A brief note is also given of the relation between additional milk solids in the ice cream mix and the overrun.

Off-flavors in butter, G. L. A. RUEHLE (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 103, 104*).—The author states that he has produced butter of metallic flavor from cream to which iron or copper lactate had been added and also by the use of cream containing organisms of the *Bacillus subtilis* group, including *B. mycoides*, *B. megatherium*, *B. vulgatus*, *B. ramosus*, and two strains of *B. subtilis*. The bacteria are thought to produce the flavor by decomposing the casein. Since the organisms of the *B. subtilis* group are spore-formers and not apt to be destroyed by pasteurization, the author holds that their presence is more harmful in milk for butter making than in milk for immediate direct consumption, and concludes that the bacteriological standards in the first case should be at least as stringent as for market milk.

The relation of the number of bacteria in milk to the quality and yield of cheese, G. J. HUCKER (*New York State Sta. Bul. 486 (1921), pp. 3–19, figs. 8*).—This is the first of a proposed series of papers dealing with the

bacteriological aspects of cheese ripening and its relation to the flora of the milk. Data for the present study were collected in the summer of 1920 from a commercial cheese factory near Philadelphia, N. Y., making full-cream Cheddar of the Young America type. Bacterial counts were made of the milk as received from the 25 patrons and as it was found in the making vat. In some cases the bacterial content was estimated from the acidity.

No striking relationship was found to exist between the bacterial content and the scores of the finished cheese, although there was a tendency for milk with the largest number of organisms (12 to 42 million bacteria per cubic centimeter) to produce cheese of fair quality and constant grade, while cheeses from milk of low count were variable in quality. The number of bacteria seemed definitely without influence on the yield of cheese. It is pointed out that the method of grading milk for direct consumption on the basis of total number of bacteria is not applicable to the grading of milk for cheese, since the specific types present are of more importance than the total number.

Favorable action of selenium on some molds originating in the cheese Industry, A. Némec and V. Káš (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 746–748*).—The authors found that the presence of sodium selenate in very dilute concentrations favored the germination and growth of spores of *Penicillium candidum*, *P. album*, *P. roqueforti*, and *P. aromaticum casei* when cultivated in Raulin's fluid, modified for each species as suggested by Dvořák (E. S. R., 44, p. 575).

VETERINARY MEDICINE.

Manson's tropical diseases, a manual of the diseases of warm climates, edited by P. H. Manson-Bahr (*New York: William Wood & Co., 1921, 7. ed., rev. and enl., pp. XVI+960, pls. 27, figs. 435*).—This is the seventh revised and enlarged edition of the work previously noted (E. S. R., 32, p. 177), of which the sixth edition was issued in 1917.

Pharmaceutical bacteriology, A. Schneider (*Philadelphia: P. Blakiston's Son & Co., 1920, 2. ed., rev. and enl., pp. X+441, figs. 97*).—The present edition, in addition to a fuller treatment of many of the sections of the previous edition (E. S. R., 26, p. 882), contains new chapters on the origin of bacteria, symbiology, zymology, and adenology.

Effects of secretions of certain parasitic nematodes on coagulation of blood, B. Schwartz (*Jour. Parasitol., 7 (1921), No. 3, pp. 144–150*).—"The substance in species of Strongylus that inhibits coagulation of blood is present in the posterior as well as in the anterior portion of the worms. *Bustomum phlebotomum*, a hookworm parasitic in cattle, contains a substance soluble in salt solution that inhibits coagulation of blood for considerable periods, which vary with different samples of blood. A closely related species, *B. trigonocephalum*, contains a similar anticoagulin. Salt solution extracts of *Haemonchus contortus* cause but a slight delay in coagulation of blood. Extracts of *Syngamus trachealis*, *Dictyocaulus filaria*, and *Stephanurus dentatus* do not retard coagulation of sheep blood. Extracts of *Oesophagostomum columbianum* do not retard coagulation of rabbits' blood. The body fluid of *Ascaris lumbricoides* inhibits coagulation of blood to a moderate extent. Extracts of *A. equorum* and of *Belascaris* sp. have a slight effect on coagulation of sheep's blood.

"In view of the fact that the delay in coagulation of blood due to extracts of nematodes occurs in vitro, that it varies with extracts of different species of worms, and that extracts of certain species produce no delay in coagulation, it may be concluded that specific substances other than proteins in solution

must be involved. The substances in question appear to be physiologically related to hirudin and snake venom, and, like the latter, are probably part of a complex of toxic principles. So far as present knowledge goes, nematodes which contain substances that inhibit coagulation of blood to a marked degree are zoologically related, belonging to the family Strongylidae, the members of which have a buccal capsule adapted to lacerating the intestinal mucosa. That the injection of their secretions into the intestinal mucosa by certain biting nematodes, resulting in minute hemorrhages, is of etiological importance in nematode diseases appears very probable."

Intravenous administration to mice, rats, and guinea pigs, G. B. Roth (*Pub. Health Rpts. [U. S.], 36 (1921), pp. 661–665, pls. 2, figs. 3*).—Methods employed are described and illustrated.

Report of veterinary department, L. L. Lewis (*Oklahoma Sta. Rpt. 1920, pp. 54, 55*).—Several vermifuges were tested during the year, with various results. "Oil of chenopodium was found to be very harmful to chickens when used in sufficient quantity to remove worms. Santonin showed an efficiency of about 40 to 50 per cent against ascarids, 15 to 25 per cent against tapeworms, and about 2 per cent against Heterakis. Chloroform and eucalyptus was found to be very effective against ascarids."

In the course of several treatments for stomach worms in sheep copper sulphate was found to be more effective when tobacco was administered with it. Progress is said to have been made in investigations of the use of killed and of sensitized cultures of abortion germs for cattle as a means of immunizing against contagious abortion. Experiments were carried out with a view to determining the nature of the disease affecting swine commonly known as mixed infection, particularly after vaccination for hog cholera with simultaneous treatment.

[Report of the] parasitology department, J. W. Scott (*Wyoming Sta. Rpt. 1920, pp. 133–138*).—In reporting upon the more important experimental results obtained in transmission work with swamp fever in horses, it is pointed out that the blood of one horse was still highly virulent four and a half years after infection, and that one of the experimental horses appeared to be immune to the disease. Saline extracts from *Tabanus septentrionalis* failed to produce the disease in a healthy horse into which it was subcutaneously injected. The investigations indicate that the virus of swamp fever occurs in the nasal secretion of horses suffering from the disease.

Reference is made to a study of the life cycles of *Moniezia expansa*, *Thysanosoma actinioides*, and *Sarcocystis tenella* (E. S. R., 43, p. 786; 44, p. 184).

Observations on the screen wire durability tests conducted in cooperation with the Bureau of Entomology, U. S. Department of Agriculture, which have extended over a period of three years, show all the wire panels still intact. While some of the panels show considerable stretching due to wind, the tests indicate that the corrosive effects of weathering are remarkably slow in the climate of Laramie.

Reports on operations of the veterinary sanitary service of Paris and the Department of the Seine during the years 1918 and 1919, H. Martel (*Serv. Vét. Sanit. Paris et Dépt. Seine, Raps. Opér., 1918, pp. 154, figs. 4; 1919, pp. 167, figs. 11*).—These are the usual annual reports (E. S. R., 41, p. 777), dealing with the occurrence of infectious diseases of animals, meat inspection, etc., with tabular data.

[Losses of stock in Arizona from poison plants], J. J. Thornber and J. G. Brown (*Arizona Sta. Rpt. 1920, pp. 455, 456, 457–459*).—Losses of stock from poison plants was heavier than for some years past, no less than 30 complaints being received during the spring from southern Arizona and a considerable

number from central and northern Arizona. The following are mentioned as the most important of these poison plants: Spreading loco (*Aragallus nothoxus*), Thurber's loco (*Astragalus thurberi*), hairy loco (*A. bigelowii*), tall loco (*A. diphysus* and *A. diphysus macdougali*), purple loco (*Aragallus lamberti*), blue larkspur (*Delphinium scaposum*), prairie larkspur (*D. camporum*), and death camas (*Zygadenus elegans*).

At Patagonio, Elgin, and certain other localities the loco poisoning was quite different from that ordinarily observed, the stock becoming weak in the back, breaking down, and to a great extent losing the power of their hind legs. This is called "tottering loco," and is thought to be caused by *A. nothoxus*, a small loco weed which grows low and spreads out on the ground.

Investigations were made of losses on the range during the winter season, southwest of Tucson, thought to have been caused by the rayless goldenrod, or burro weed (*Bigelowia coronopifolia*). The first indication of this disease is a lack of thrift. The animals become gaunt and listless, separate from the herd, and lie down, while the horses appear fagged as if overridden and exhausted. The disease seems to exist in an acute and a slower form. In the acute form the animals have some fever and die within a day or so, while in the slower form they linger three to five days, losing flesh and becoming weaker. "A few hours before dying they tremble violently, often fall down with the legs spread out, drop the head and neck, and froth at the mouth. Some animals break down over the loins and fall down with their hind legs sprawled out. The disease attacks both sexes and all sizes, ages, and conditions of animals, and very few of the affected ones recover."

In feeding experiments made with the rayless goldenrod, a meal made by grinding the dried stems, leaves, and herbaceous growth, to the amount of 150 lbs., was eaten by a mare, having been fed as much as 2.5 lbs. daily with at least an equal amount of rolled barley and bran. Though the mare disliked the goldenrod meal, she ate it and showed no symptoms of poisoning, but during the experiments she lost about 5 lbs. in weight. Since but one animal was used, the results obtained are not deemed conclusive.

Poisonous plants of Wyoming, O. A. Beath (*Wyoming Sta. Bul. 126 (1921), pp. 35, figs. 18*).—Following a brief general account of the nature of stock poisoning by poisonous plants, and preventive measures, summarized accounts, accompanied by illustrations, are given of the plains, tall, and low larkspurs, silvery lupine, death camas, woody aster, water hemlock, arrow grass, white loco, wooly or purple loco, two-grooved milk vetch, broad-leaved or showy milkweed, slender Psoralea, and aconite.

[Studies of poisonous plants], O. A. Beath (*Wyoming Sta. Rpt. 1920, pp. 130, 131, 132, 133*).—A preliminary study was made of *Glaux maritima* with a view to determining its possible relation to a disease commonly occurring among cattle during the grazing season, and the winter feeding of hay. Alcoholic extracts prepared from fresh material were highly toxic when injected intravenously into full-grown rabbits, but gave negative results when fed to cattle and sheep for a period of 17 days.

Sheep fed moderate quantities of *Astragalus bisulcatus* for a period of 15 days failed to develop any symptoms of poisoning. Laboratory tests in which extracts from *Triglochin maritima* were introduced intravenously into rabbits show it to be highly toxic, but no poisonous symptoms were observed when it was fed in a green condition to cattle.

Contribution to the study of microorganisms antagonistic to the anthrax bacillus.—Experimental researches, W. Silberschmidt and E. Schoch (*Ann. Inst. Pasteur, 34 (1920), No. 10, pp. 669–683*).—By means of inoculation experi-

ments on guinea pigs, rabbits, and mice, the authors have demonstrated that certain microorganisms, including the Friedlander bacillus, *Bacillus typhosus*, *B. coli*, and *B. pyocyaneus*, when injected simultaneously with *B. anthracis*, exert an antagonistic action on the latter organism and prevent death from anthrax. If the two antagonistic organisms are injected in different places or at different times, or if the organisms have been killed by heat, this does not happen. The resistance to anthrax infection does not confer immunity. No relation was found to exist between the antagonistic action in vitro and in vivo, as shown by the fact that *B. pyocyaneus* had an inhibiting effect both in vitro and in vivo, while the Friedlander bacillus showed this property only in vivo.

Etiology of acute gangrenous infections of animals: A discussion of blackleg, braxy, malignant edema, and whale septicemia.—Studies on pathogenic anaerobes, H. H. HELLER (*Jour. Infect. Diseases, 27 (1920), No. 5, pp. 385–451*).—This report of an extensive investigation of the etiology of acute gangrenous infections of animals, which should be consulted in the original for numerous details, consists of a general discussion of the principal organisms involved in the anaerobic infections of domestic animals, the report of an investigation of material derived from animals, with a classification of 54 strains of pathogenic tissue-invading anaerobes derived from the material, and a critical review and analysis of the literature on the anaerobic infections of animals.

The organisms studied are placed in two groups, the blackleg and the Vibrion septique groups, the criteria of distinction between which are fully defined. As based on these criteria, the author concludes that cattle are subject to spontaneous infection by organisms of the blackleg group and less frequently by organisms of the Vibrion septique group, both of which are generally diagnosed as blackleg. Sheep are subject to infection by the organisms of the Vibrion septique type more frequently than by those of the blackleg type, both types of infection being diagnosed somewhat indiscriminately as braxy, blackleg, and malignant edema. Horses are subject to Vibrion septique infection and to infection by the edematiens group, while true blackleg group infection has probably never been demonstrated. Hogs are subject to infection by members of the Vibrion septique, but not by the blackleg type. The names "malignant edema," "Ghon-Sachs bacillus infection," "specific gas phlegmon of hogs," and "bradsot" depend upon the location of the lesions involved.

Other points noted in general are the comparative rarity of edematiens group infections in animals except the horse and the great rarity of serious invasion of animals by *Bacillus welchii;* the greater susceptibility of ruminants than of Carnivora or Omnivora to spontaneous anaerobic infection; the dependence of all immunization work in connection with anaerobic disease on a recognition of the group affinities of the anaerobic organism infecting the animals of the particular district in which immunization is proposed; and the present lack of knowledge of the epidemiological factors of anaerobic infection.

In conclusion, the author makes a plea for "the world-wide study of these infections. They cost every agricultural country vast sums every year, and notable steps in the direction of immunization have shown that such immunization is feasible. To decide definitely the mode of infection in these diseases and the incidence of the group and specific entities involved would be of immense value to any country and to the world at large. The specificity of the toxins and of the aggressins of the different members in each group must be investigated. There are a hundred interesting immunologic and epidemiologic problems to be suggested. The proper investigation of the subject can be done only in a laboratory that is well equipped to handle anaerobes and that has the funds

to employ a trained epidemiologist who knows something of veterinary pathology and can spend all his time in the field."

An extensive bibliography is appended.

Blackleg, W. E. KING (*North Amer. Vet., 1 (1920), No. 9, pp. 436–438*).—A review of recent literature, particularly the paper by Heller noted above.

Foot-and-mouth disease.—Dangers of aphthisation by the use of virulent serum, C. LEBAILLY (*Rec. Méd. Vét., 96 (1920), No. 21, pp. 591–593*).—The author reports a case in which attempted immunization against foot-and-mouth disease by the method described by Moussu (E. S. R., 45, p. 383) resulted in a sudden development of the disease with fatal outcome. This is mentioned as showing that the method of aphthisation by intravenous inoculation of virulent serum is not without danger.

Comparative studies of the value of the lid test, conjunctival test, and blood test for glanders, E. FRÖHNER and HABERSANG (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 1–2, pp. 1–20, figs. 8*).—The authors use the term lid test to denote the intrapalpebral or intradermal mallein reaction. A comparative study of this, the conjunctival test, and the agglutination and complement fixation tests is reported, from which the conclusion is drawn that the lid test is as reliable as the conjunctival and blood tests and has the advantage over the conjunctival test in that it is more sensitive, of longer duration, can not be blotted out by artificial means, and in pronounced cases is easily detected by the most inexperienced veterinarian. A disadvantage of the lid test as compared with the conjunctival is that it is sometimes difficult to distinguish between a pathological swelling and the natural swelling of the eyelids of healthy animals as a result of the irritation caused by the injection. For this reason the test is to be considered positive only when in addition to swelling of the lid there is a decided suppurative discharge. The lid test, contrary to the conjunctival test, can not be used in connection with the serological tests as it tends to interfere with the latter. As both the lid and the conjunctival tests react in 15 hours, while a decision can not be made in the case of the blood tests within 11 days, the former are recommended as much more satisfactory.

Studies of the influence of the lid test (intrapalpebral mallein test) on antibody formation in healthy horses, K. F. BELLER (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 11–12, pp. 545–562*).—The author presents evidence to prove that the interference of the blood tests for glanders (agglutination and complement fixation tests) by the intrapalpebral test, as noted in the above paper, is due to the strength of mallein used, and that if the mallein be diluted this interference does not take place. A list of 28 literature references is appended.

The incidence of bovine infection in tuberculous meningitis, N. NOVICK (*Jour. Med. Research, 41 (1920), No. 2, pp. 239–246*).—"Forty-eight strains of tubercle bacilli have been isolated from the cerebrospinal fluid of 48 clinical cases of tuberculous meningitis. Three of the strains have proved to be of the bovine type. Moist growth of Dorset's media, while characterizing the bovine virus to a certain extent, needs rabbit virulence confirmation to make it certain. Pigment production on egg media characterizes to a certain extent the human virus, this characteristic depending upon the age of the culture."

The action of benzyl alcohol on toxins and on tuberculin, J. JACOBSON (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 14, pp. 525–527*).—The studies previously noted (E. S. R., 43, p. 584) have been extended to include the effect of benzyl alcohol on tuberculin as shown by the temperature reaction, general symptoms, and mortal doses for experimental guinea pigs. Experimental evidence is furnished that benzyl alcohol has an ameliorating effect on the temperature and general symptoms of the disease. It is also stated

that mortal doses of diphtheritic and tetanic toxins mixed in vitro with benzyl alcohol and then injected subcutaneously into rabbits do not prove fatal.

The action of benzyl alcohol in experimental tuberculosis and on red blood corpuscles, J. JACOBSON (*Compt. Rend. Soc. Biol.* [*Paris*], *83* (*1920*), *No. 30, pp. 1350, 1351*).—Continuing the study noted above, evidence is presented that tubercle bacilli, which, even when destroyed by heating at 120° C., are capable of provoking abscesses in guinea pigs, lose this power after treatment with benzyl alcohol. Benzyl alcohol has been found not to hemolyze blood, but to deepen the red color of the blood corpuscles, the action being considered a phenomenon of oxidation.

Experiments with conjunctival and intracutaneous tuberculin tests, G. REGNÉR (*Edinburgh: W. & A. K. Johnston, Ltd.* [*1920*], *pp. 81*).—The author, who is chief of the bureau for tuberculosis among cattle of the Royal Swedish Board of Agriculture, Stockholm, has made an extensive investigation of the relative merits of conjunctival and intracutaneous tuberculin tests, the results of which are reported and discussed in this publication.

The conjunctival test, although admittedly rapid of execution and observation, is considered very unreliable in that the dose can never be exact, and the reaction is difficult to distinguish from simple inflammation or conjunctivitis, often being given by cattle proved on autopsy to be nontuberculous. The intracutaneous method has the disadvantage of being a rather difficult and slow procedure and one which requires some practice in correct reading of results, but has the advantage of not being so subject to external influences as the conjunctival test and of requiring less tuberculin. While in the opinion of the author it should not entirely supersede the thermal test, it is considered of great value as a supplementary diagnostic procedure.

Infectious abortion in cattle: The herd bull as a factor in transmitting the disease, E. T. HALLMAN (*Michigan Sta. Quart. Bul., 3* (*1921*), *No. 3, p. 81*).—This is a supplement to Circular 40, previously noted (E. S. R., 41, p. 479).

Report on an epizootic disease among calves at the Amara Dairy Farm, T. H. GLOSTER and G. SHANKS (*Indian Jour. Med. Research, 7* (*1919*), *No. 2, pp. 382–397*).—This reports investigations made in a herd in which there had been a high mortality among young calves. In this disease, which in its severe fatal form affects chiefly calves of from 1 to 3 weeks of age, the characteristic lesion is ulceration and necrosis of the intestinal mucous membrane, being usually limited to the lower ileum, caecum, and upper part of the colon.

"The results of agglutination tests carried out with the sera of healthy calves and dams against the calf bacillus show that the infection was widespread among the cattle at the dairy farm, and that many infected calves recovered.

"The calf disease is associated with a bacillus of the paratyphoid Gaertner group which is present in the blood, bile, organs, mesenteric glands, and intestinal ulcers of calves which die of the disease. The calf bacillus differs from the paratyphoid B and the paratyphoid C bacilli. It is probably an aertrycke bacillus, but the experimental evidence obtained in this investigation does not exclude the possibility of its being Gaertner's bacillus.

"The bacillus is pathogenic to rabbits and guinea pigs and to calves when given intravenously. The calf bacillus is probably not capable of causing an enteric-like fever in man, but in certain circumstances the ingestion of the flesh of infected animals might give rise to 'food-poisoning' outbreaks. The question whether the calf disease is due to a filterable virus with a secondary infection by the aertrycke-like bacillus has not been decided. Further work is required to settle the question, which is important from the point of view of prophylaxis. If the disease is due to a filter passer, not much protection can be expected from the employment of vaccines prepared with the calf bacilli."

Internal parasites affecting sheep and goats, D. H. BENNETT (*Texas Sta. Circ. 28 (1921), pp. 3–16, figs. 9*).—A popular summary of information on the more important parasites of these animals.

The normal blood of the horse, its specific gravity and hemoglobin index, measured with Sahli's hemometer, H. BONARD (*Le Sang Normal du Cheval sa Dénsité et sa Teneur en Hemoglobine Mesurée avec l'Hémomètre Sahli. Inaug. Diss., Univ. Bern, 1919, pp. 39, figs. 3*).—The author finds the average specific gravity of the blood of the horse to vary from 1.048 to 1.055, it being about 1.054 for the saddle horse, 1.050 for the coach horse, and 1.048 for the draught horse. The specific gravity varies with the age; it falls during the first days of life, gradually rises up to the age of 2 to 3 years, falls considerably at 4 years in imported horses, reascends rapidly at about 5 years, and rises somewhat up to 14 years, then diminishes somewhat as the age increases. Sex has an influence on the specific gravity, it being from 3 to 4 mm. higher in the stallion, but there is no difference whatever in the gelding and the mare. Race and breeding have an influence, the specific gravity being higher in pure-bred and decreasing somewhat as the type approaches that of the draught horse.

The hemoglobin index measured with Sahli's hemometer is from 50 to 60 for the average horse, and from 60 to 65 for the coach horse. It varies with the specific gravity under the influence of age, sex, race, temperament, exercise, and transpiration.

Pyosepticemia or arthritis of foals, L. PANISSET (*Rev. Gén. Méd. Vét., 29 (1920), No. 339, pp. 113–128*).—This is a review and discussion of recent contributions to the literature on arthritis or joint-ill in foals and its relationship to contagious abortion in mares, including particularly the studies of McFadyean and Edwards (E. S. R., 42, p. 680) and Magnusson (E. S. R., 42, p. 679) on the etiology of the disease and of these authors, Forssell (E. S. R., 42, p. 382), and Scott (E. S. R., 43, p. 585) on the prophylactic and therapeutic measures for the control of the disease.

The author concludes that preventive inoculation should be employed wherever the appearance of arthritis is the rule, but that whatever the efficacy of one or another of the methods advocated a certain number of failures is to be expected, attributable to other causative agents than the colon bacillus and streptococcus. It is also emphasized that whatever the treatment, nothing should authorize neglect of the navel. "The arguments furnished in favor of a relation between the infection of the mare and its foal are doubtless applicable only in certain cases, and their knowledge should not justify the abandonment of a procedure of prevention, the value of which has been established by a long and extensive experience."

Prolapse or so-called "blowouts," W. T. JOHNSON (*Washington Sta., West Wash. Sta. Bimo. Bul., 9 (1921), No. 3, pp. 42–44, fig. 1*).—A brief popular account of this affection in poultry.

A study of chicken pest, C. JOUAN and A. STAUB (*Ann. Inst. Pasteur, 34 (1920), No. 5, pp. 343–357*).—Following a brief historical introduction, the authors report a series of studies on chicken pest, the results of which may be summarized as follows:

Pigeons and chickens reacted differently following inoculation with the virus. Chickens inoculated intramuscularly with blood from a bird which had recently succumbed to the disease died within from 36 hours to 4 days with the dilutions as great as 0.000001 cc., while pigeons sometimes succumbed and sometimes resisted a like inoculation. Infected chickens died without showing any nerve symptoms, while the pigeons which succumbed presented symptoms

of nerve degeneration. It was possible with proper dosage to transmit the disease from pigeon to pigeon.

Immunity to the disease could be conferred upon chickens by intravenous inoculation of heated virulent blood. Chickens thus hyperimmunized furnished an active microbial serum which protected the birds against the virus injected 24 hours later. By mixing the virulent serum with washed globules of rabbit blood the alexin of the serum was destroyed. A mixture of this virus with the serum of the hyperimmunized fowls, heated at 56° C., was capable of conferring immunity when injected into pigeons.

Preliminary results are also reported of an attempt to multiply the virus in eggs during incubation. This was accomplished when the inoculation of the egg took place after the third day of incubation.

The effects of the administration of chaparro amargosa [Mexican bitter bush] on the intestinal protozoa of the turkey, E. E. Tyzzer (*Jour. Med. Research, 41 (1920), No. 2, pp. 211–217*).—"Chaparro amargosa may be fed in considerable amount with grain to young turkeys without injurious effect, except that the growth of the latter may be somewhat retarded on account of less hearty feeding.

"The daily administration of this drug throughout a period of exposure to blackhead has not served to prevent this disease. *Entamoeba gallinarum* has with rare exceptions disappeared from the excrement of turkeys under treatment. This finding lends support to the results obtained by others in the treatment with chaparro amargosa of entamoebic infections of man. Trichomonads have shown no diminution, and apparently are unaffected by chaparro. A coccidium, *Eimeria avium*, has disappeared in the majority of the treated turkeys.

"The selective action of chaparro amargosa with respect to the last three parasites is thus significant when considered together with its failure to prevent blackhead. The physiological evidence obtained is in accordance with morphological observations, indicating that the parasite of blackhead is not closely related to the familiar species of parasitic amoebae."

Observations on the transmission of "blackhead" in turkeys.—The common fowl as a source of infection, E. E. Tyzzer (*Jour. Med. Research, 41 (1920), No. 2, pp. 219–237, figs. 4*).—This is a report of observations made during the course of the investigations noted above.

It is stated that there is no indications that unfavorable conditions will be themselves produce blackhead in turkeys, unless the specific organism is present. The exposure of young turkeys to two infected turkeys, one in the acute stage of the disease, the other about to recover, resulted in two cases of blackhead, but further exposure to the recovered birds was without results. The repeated feeding of diseased tissues and discharges from cases of blackhead to normal birds failed to produce the disease.

A list of 13 references to the literature is given.

The correlation between the chemical composition of anthelmintics and their therapeutic values in connection with the hookworm inquiry in the Madras Presidency, J. F. Caius and K. S. Mhaskar (*Indian Jour. Med. Research, 7 (1919), No. 2, pp. 429–463*).—"Thymol is a solid drug of constant chemical composition, not deteriorating with age, and easily obtained in the pure state. Its dosage is thus easy and certain. Free thymol is very soon eliminated from the system, the danger of poisoning for the host thus being greatly diminished; and its quick disappearance from the intestine renders the afterpurge and any restriction on the nature of the food unnecessary. Up to a 60-grain dosage thymol is a safe drug. Thymol is a powerful vermicide, acting

both on Ankylostoma and Necator. Any dose from 30 to 60 grains administered in one portion will prove effective. Thymol has mild vermifugal properties."

A list of 47 references to the literature is included.

RURAL ENGINEERING.

The management of sandy soils under irrigation, H. K. DEAN (*Oregon Sta. Bul. 177 (1921), pp. 26, figs. 13*).—The results of experiments, conducted at the Umatilla Substation on the management of sandy soils under irrigation, which have embraced chiefly crop testing, soil moisture and irrigation methods, and fertility improvement, are summarized.

It is pointed out that if light soils are to be permanently farmed under irrigation a balanced system of agriculture should be practiced, with rotations and enough live stock to consume the feed produced on the farm. Excessive grading of light soils exposes the subsoil, which is deficient in organic matter and of coarser structure than the surface soil, and results in greater difficulty in handling and in reduced crop yields.

The water distribution system should be so constructed as to provide for the use of large heads of water. The use of gates for turning the water on the land is deemed much more satisfactory than cutting the ditch banks. The border method of irrigation has been found to be the most suitable for light soils. The use of straw prevents soil movement until the cover crop has become established, and rye has been found to be the most satisfactory nurse crop. The most economical interval of irrigation for alfalfa on medium sandy soil is said to be once in two weeks. An application of 8 tons of manure to the acre was found to increase the yield of hay 1.33 tons, while 32 tons increased it only 2.29 tons.

[Studies of irrigated soils and irrigation waters], A. E. VINSON, C. N. CATLIN, and S. W. GRIFFIN (*Arizona Sta. Rpt. 1920, pp. 436–439*).—Studies of the tolerance of wheat in black alkaline soil indicated the tolerance to be somewhat over 0.2 per cent of sodium carbonate. It is noted that healthier looking plants were obtained in pots containing from 0.1 to 0.15 per cent of sodium carbonate than in those containing small amounts of alkali. The grain yields, however, were higher in the soils containing 0.05 per cent of sodium carbonate. The heaviest grain yields of all were obtained in soils containing 0.2 per cent of sodium carbonate, with sufficient gypsum added to exactly neutralize the sodium carbonate. Larger amounts of gypsum did not increase the yield, but one-half and one-fourth of the amount required to neutralize the sodium carbonate gave some increase over the untreated check.

Monthly analyses of water from the Tempe drainage ditch are also reported.

Rules for the blending of pump water with canal water under the Salt River Valley project are included. These state that the blended water delivered to irrigators may contain not more than 50 parts per 100,000 of chlorid estimated as sodium chlorid, or not more than 100 parts per 100,000 of total dissolved salts. Black alkaline waters may not be blended in proportions that will give the blended water a permanent black alkaline content. Pump water that shows by analysis at the time a lower content of chlorids and total dissolved salts than the unblended water of the canal into which it is pumped may be used in any quantity.

Data are also given on the character of the ground waters immediately east of the Agua Fria River.

Irrigation investigations, G. E. P. SMITH, W. E. CODE, and H. C. SCHWALEN (*Arizona Sta. Rpt. 1920, pp. 475–479*).—A general summary is given of the irrigation situation in Arizona for the fiscal year 1920, including especially data on

the development of ground and surface waters in the Casa Grande, San Simon, San Pedro, and Sulphur Spring Valleys. It is stated that in silt studies of the waters of the Gila River, begun in 1917, and in which over 1,100 samples of river water were collected and analyzed, the total amount of silt carried by the river in a period extending over nine months was 196.5 acre-feet, which was 0.3 per cent of the river discharge for the period.

Study of efficiency of underdrains, H. M. LYNDE (*North Carolina Sta. Rpt. 1920, pp. 67–69*).—Experiments in cooperation with the U. S. Department of Agriculture to determine the amount of run-off from underdrained land, the relation of run-off to rainfall, and the action of tile drains in lowering the ground water level on three farms in North Carolina are reported.

On the Cotton Valley farm in Edgecombe County the soils on the tract investigated are second terrace deposits. It was found that the texture of the soil is the controlling factor in the efficiency of tile drainage, and that the spacing of the drains should be such as to suit average soil conditions as nearly as they can be determined. Before designing drainage systems in nonhomogeneous soils, frequent borings to a depth of 3 ft. should be made to determine the soil textures. In general, it is stated that laterals should be arranged in parallel, straight lines at equal distances apart and at the same average depth. The minimum economic spacing recommended is 60 ft. and the maximum depth 3 ft. A run-off factor of ¼ in. in 24 hours from the underdrained area is considered to be ample for use in the design of the mains and submains. The minimum grade recommended is 0.2 per cent, and if flatter than this, the joints between tile should be protected against the entrance of silt.

In similar experiments on the Lewis farm in Pitt County it has been found that the Norfolk and Portsmouth sandy loam soils are of an open nature and respond almost immediately to tile drainage if an outlet is provided. A spacing of 120 ft. and a depth of 3½ ft. may be adopted for laterals in these soils. The economic rate of run-off to be adopted for underdrainage systems on areas similar to this appears to be between ¼ and ⅜ in. in 24 hours. It has been found that there is no danger of the silting up of 4-in. tile laid on grades of 0.3 per cent or more in these soils.

Experiments at the Black Land station in Washington County on muck soil, to determine the action of underdrains in lowering the ground water level by means of 69 wells, indicated that it is apparently impossible to overdrain these muck soils and that tile operate successfully on a grade of 0.04 per cent in the clay subsoils of this section. No final conclusions are drawn.

Run-off data on drainage canals, H. M. LYNDE (*North Carolina Sta. Rpt. 1920, p. 67*).—The progress results of studies in cooperation with the U. S. Department of Agriculture of run-off on Third Creek Canal, Iredell County, are summarized, indicating that a run-off factor of 1 in. in 24 hours over the watershed should be adopted in the design of drainage ditches in the Piedmont region of North Carolina. It has been found that the average annual run-off on Third Creek is approximately 43 per cent of the average annual rainfall. The results are also taken to indicate that the daily rainfall recorded at one station on a watershed does not represent true daily rainfall conditions. To obtain an approximate true rainfall it is necessary to average the records of several stations scattered over the watershed. For small watersheds with rainfall conditions as they are on Third Creek one rainfall station for each 10 square miles is apparently not too frequent.

Installing drainage system on the Washington County Experiment Farm, S. C. HARTMAN (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 77–81, figs. 2*).—General information is given on the operations and cost of trenching,

hauling, and laying tile in the drainage of the Washington County Experiment Farm. The soil varies from a comparatively light clay to a heavy red clay and is underlaid with shale and sandstone. In a comparison of hand and machine work in trenching and tile laying it was found that, allowing 30 cts. per rod for the ditching machine, hand trenching and laying cost from 170 to 180 per cent more than machine trenching and laying. With hand trenching an average of 1.6 hours of labor were spent on each rod, with machine trenching 0.14 of an hour, exclusive of the machine operator.

Surface water supply of Pacific slope basins in Washington and upper Columbia River Basin, 1917 (*U. S. Geol. Survey, Water-Supply Paper 462 (1921), pp. 181+LI, pls. 2*).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, presents the results of measurements of flow made on streams in Washington and in the upper Columbia River Basin during the year ended September 30, 1917.

Records of water levels in wells in southern California, F. C. EBERT (*U. S. Geol. Survey, Water-Supply Paper 468 (1921), pp. 156, pls. 4, fig. 1*).—This report, prepared in cooperation with the State of California, contains records of the fluctuations of water levels in a large number of wells in the lowland region of southern California. This includes the San Bernardino Valley, the foothill belt between San Bernardino Valley and Los Angeles, the Coastal Plain west and south of Los Angeles, and the San Jacinto Valley and adjacent areas.

Method for clarifying stagnant water, especially in ponds or lakes, C. E. SANBORN (*Oklahoma Sta. Rpt. 1920, p. 46*).—Experiments are briefly reported in which it was found that a treatment of 25 lbs. of copper sulphate to the acre of stagnant water 4 ft. in depth is sufficient for the clarification of such water and to favor fish life.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 2, pp. 36, figs. 14*).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in April, 1921, and the following articles:

Accelerated Wear Tests by the Bureau of Public Roads, by F. H. Jackson and C. A. Hogentogler (see below); On Bituminous Macadam and Bituminous Concrete Roads, by E. J. Wulff; Tests of Road-building Rock in 1920; and Status of Federal Aid, April 30.

Accelerated wear tests by the Bureau of Public Roads, F. H. JACKSON and C. A. HOGENTOGLER (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 2, pp. 3–21, figs. 14*).—The results of a series of accelerated wear tests upon granite block, vitrified brick, and concrete pavement surfaces conducted at the Arlington (Va.) Experiment Station are reported. The purposes of the tests were to compare the behavior of various forms of the several types of pavement when subjected to specially heavy steel-tired traffic, and to ascertain whether the resistance to wear of the constituent parts of the several pavement types, as determined by laboratory tests, may be considered as a reliable index of the wearing value of these materials when combined in a pavement.

The various materials were incorporated into a number of pavement sections laid in the form of a runway approximately 400 ft. long by 2 ft. wide. In all there were 48 sections, 21 of which were brick, 19 granite block, and 8 concrete. The base for the granite block and brick sections was 8 in. of 1:3:6 concrete laid upon compacted cinder fill. The concrete sections were laid immediately upon the cinders. Four different 1-in. bedding courses were laid over the base in the granite block sections, namely, (1) 1:4 dry cement mortar, (2) sand, (3) asphalt-sand, and (4) tar-sand. The brick were similarly

laid on sand and sand-cement cushions. Both granite block and brick were filled in the various sections severally with 1:1 cement grout, asphalt, tar, and asphalt and tar mastics.

The wear testing machine consisted of 5 cast-iron wheels 48 in. in diameter by 2 in. wide and each weighing 1,000 lbs. The wheels were mounted inside a channel-iron frame in such a way that they rolled over the center 12 in. of the 24-in. test strips. Each wheel was mounted independently so as to move up and down freely and thus adjust itself to any inequalities or depressions. The machine was pulled back and forth at the rate of approximately 5 miles per hour.

The following general conclusions are drawn from the granite block tests: "Bituminous-filled granite block pavements will resist the impact produced by heavily loaded steel-tired traffic as well as cement-grouted pavements. Bituminous mastic fillers are as satisfactory for this type of traffic as straight bituminous fillers. The effect of impact is tremendously increased by irregularities produced by poorly cut block. Irregularities of surface or other factors producing impact are more serious with grouted than with bituminous-filled pavements. Slight variations in resistance to wear, such as occur among the commercial granite block from the Atlantic coast quarries, are of much less importance in judging the probable resistance of the block to the action of traffic than has commonly been supposed. Cement-sand bedding courses are more satisfactory than sand or bituminous-sand bedding courses."

In the brick tests it was found that the progress of wear was similar in all sections. First the excess filler was broken and pulled off the surface of the bricks, then a uniform wearing of the bricks occurred over the entire length of the section. This uniform wear was followed by excessive wearing in spots, causing a very rough and uneven surface. Complete failure of the section rapidly followed this uneven condition. In sections with elastic fillers the wear was confined to the areas which came in contact with the cast-iron wheels, causing ruts or grooves to develop as the test continued. In sections having nonelastic fillers the wear was of a crushing or shattering kind, causing the bricks to shear and break in areas adjacent to as well as in the path of the wheels.

The following conclusions are drawn from the brick tests: "The edge protection offered by bituminous and cement-grout fillers is considerably greater for vertical fiber and wire-cut lug than for repressed brick. The adhesion of bituminous fillers to wire-cut lug and vertical fiber brick tends to protect the surface and to reduce the wear. With cement-grout fillers the surface becomes a rigid slab and failure occurs because of the breaking of this slab under load and consequent loosening and shattering of the brick. With cement-grout fillers and sand-cushion construction the brick must be so thick as to make a slab which will resist without excessive distortion the impact produced by the load moving over it. In such cases the cement-grout filler offers excellent support to the wire-cut lug and vertical fiber brick. The above results indicate that for sand and sand-cement cushions and for such loads as were had at Arlington thicknesses under 4 in. are impractical. For brick of sufficient thickness to form a beam which will not be broken under impact cement grout offers better support to the edges than bituminous fillers. The bituminous fillers cushion the edges, but under certain kinds of traffic (steel tires) allow the edge to be crushed even while the filler remains intact.

"Tar and tar-mastic fillers form more rigid slabs in cold weather than asphalt and asphalt mastic, and consequently brick filled with the former tend more toward shattering than those filled with the latter. For the same conditions of brick and type of construction, brick with rounded edges offer less resistance to wear than those with square edges. Sand cushions are subject

to more compression than sand-cement cushions, and the greater compression results in a more uneven surface. Elastic fillers considerably reduce the effects of impact occasioned by steel-tired traffic, and the destructive effect increases with increased rigidity of the fillers, the maximum destructive effect occurring with such fillers as have greatest rigidity. The shattering of the brick and the additional settlement noted on the cement-grout sections warrant this conclusion. The resistance to wear of the various pavement sections, as shown from the wear test, is the same as that indicated by the standard rattler test for the brick comprising the above sections."

In the tests of the concrete pavement sections it was intended to secure comparisons of the resistance to wear offered by concretes made from different aggregates. Eight sections were constructed, each 6 in. thick and each of 1:1½:3 concrete. The different aggregates used included trap rock, limestone, gravel, sandstone, slag, and gneiss. During the progress of the test these sections, in addition to wear on their surfaces, developed a considerable number of transverse cracks, followed by settlement, thus subjecting them to impact.

In general the wear progressed the same on all sections, beginning with a slight grooving action, which gradually uncovered the large aggregate, after which the depth of wear, as well as the uniformity of the resulting surface, depended more or less upon the hardness and size of the aggregate. These tests showed that the trap rock and gneiss sections gave the greatest resistance to wear and presented very uniform surfaces. The gravel sections ranked next, showing slightly more wear but about the same uniformity. The limestone and sandstone sections compared favorably with the gravel as regards depth of wear, but tended more toward the development of nonuniform surfaces. The slag sections showed the least resistance to wear and compared favorably with each other. It was further found that this test shows no relation between compressive strength and resistance to wear afforded by the several concretes. The dry concretes offered more resistance to wear than the wet ones.

Observations of the transverse cracking and settlement indicated that slag, sandstone, and limestone do not offer as much resistance to cracking as gravel, trap rock, and gneiss. The tests on the concrete sections indicated that neither the resistance to wear nor the resistance to cracking are dependent upon the compressive strength of the concrete, as determined by 6 by 12 in. test cylinders, that more resistance to wear is afforded by dry concrete than by wet, and that the harder aggregates offer more resistance to wear than the soft ones.

Some fundamentals of stable ventilation, H. P. Armsby and M. Kriss (*Jour. Agr. Research* [*U. S.*], *21* (*1921*), *No. 5, pp. 343–368*).—Some of the results of cooperative investigations conducted by the Bureau of Animal Industry of the U. S. Department of Agriculture and the Pennsylvania Institute of Animal Nutrition are summarized and discussed, the purpose being to work out a method by which the results of direct determinations of the heat production of cattle and other stock may be applied to the problems of stable ventilation and the heat production in any specific case computed with a fair approximation to accuracy.

It is considered evident that the question of stable ventilation is one of maintaining the proper purity of air as well as the proper temperature. The motive power for stable ventilation discussed is that derived from the heat and water vapor produced by animals. The motive power derived from the moisture produced by different animals is said to be much less than that derived from the heat, and since its magnitude depends largely on the difference in temperature it is considered of secondary importance.

Theoretical considerations and the results of experience are said to show that a certain excess of heat production over that absolutely required to maintain the body temperature is likely to be advantageous, both by promoting the comfort of the animal and by providing a margin of safety. From this it follows that the best thermal surroundings for animals lie between a temperature somewhat above the critical point and one not so high as to affect the appetite and thrift of the animal. These limits evidently will vary with the species of animal and with the amount and character of the ration.

Considerable data on the heat production of cattle, dairy cows, horses, swine, and sheep are presented and discussed. Accepting King's assumption that the permissible percentage of carbon dioxid in the air is 0.167 by volume, data on air flow per day and per hour required to maintain this standard of purity, when based on the average computed carbon-dioxid production by the different species, are given and compared with corresponding figures prepared by King. These show a necessary air flow per hour of 3,452 cu. ft. for cows, 2,307 for horses, 767 for swine, and 332 for sheep. The air flow for cows according to the King method agrees very well with that computed from the carbon dioxid produced, but the results for the other animals are very much smaller. It is concluded that the actual carbon dioxid production is the proper basis upon which to estimate the rate of ventilation required.

Further data are given in the following tables on the average temperature differences between the stable and the outside air which can be maintained by the different animals and compared with figures computed on the basis of the King standard period. These show that cows, horses, swine, and sheep of respective average live weights of 1,075, 1,250, 280, and 91 lbs. will maintain respective average temperature differences, corresponding to air flow computed from carbon-dioxid production, of 36.58, 36.49, 36.4, and 36.5° F. The respective temperature differences computed on the basis of the King standard are 35.6, 19.6, 20, and 13.3°.

Data are also presented showing approximately the temperature of the stable when air enters at different temperatures.

Temperature in stable as compared with that outside.

Temperature of outside air.	Temperature of air in stable.				
	Basis of King's figures for ventilation.				Basis of computed air flow.
	Cow.	Horse.	Swine.	Sheep.	All.
°F.	°F.	°F.	°F.	°F.	°F.
−20	15.6	−0.4	0.1	−6.7	16.5
−10	25.6	9.6	10.1	3.3	26.5
0	35.6	19.6	20.1	13.3	36.5
10	45.6	29.6	30.1	23.3	46.5
15	50.6	34.6	35.1	28.3	51.5
20	55.6	39.6	40.1	33.3	56.5
25	60.6	44.6	45.1	38.3	61.5
30	65.6	49.6	50.1	43.3	66.5
35	70.6	54.6	55.1	48.3	71.5

The foregoing data show approximately the point at which the heat supplied becomes deficient for maintaining the proper temperature in the stable. Thus, when King's standard of air flow is taken as the minimum, the heat supplied by cows appears to become deficient for maintaining what is believed to be the best stable temperature when the outside temperature is below 15° F. The heat supplied by horses, swine, and sheep appears to become deficient at a much

higher outside temperature. However, when the rate of air flow computed from the carbon dioxid production is made the basis of the computation the differences between the species disappear.

Data are also given on the maximum ventilation compatible with the maintenance of a given temperature difference. In the specific cases used, the necessity in severe weather of restricting the ventilation in order to conserve heat and maintain a desirable stable temperature is indicated. This results in lowering the purity of the stable air below King's standard.

It is noted that the amount of carbon dioxid produced by animals is approximately proportional to their heat production, so that the rate of ventilation should also be approximately proportional to their heat production in order to maintain any desired standard of purity in the stable air. The results of these computations show that, to the extent to which the examples used may be regarded as typical, the accepted ventilation requirements for different animals are not proportional to their heat production. Assuming the value of heat production of cows as unity, the relative heat production of other animals is computed for heavy horses as 0.8, swine as 0.2, and sheep as 0.1. The relative air movement with King's ventilation requirements are 1, 1.2, 0.4, and 0.3.

The results are taken to indicate clearly the need for further fundamental investigation.

Poultry housing, J. Dryden (*Oregon Sta. Bul. 179 (1921), pp. 3–22, figs. 17*).—Popular information on the location, planning, and construction of poultry houses adapted to Oregon conditions are presented in this bulletin, together with diagrammatic illustrations and bills of material for a portable house, a 100-hen house, and a 500-hen house.

Septic tanks for the farm, J. R. Haswell (*Penn. State Col. Ext. Circ. 89 (1921), pp. 19, figs. 11*).—Popular information on the subject is given in this circular, which is based mainly on work conducted at the New York State College of Agriculture and noted from time to time in the *Record*.

RURAL ECONOMICS AND SOCIOLOGY.

The agricultural-historical theories of Eduard Hahns, R. Krzymowski (*Landw. Jahrb., 53 (1919), pp. 485–499*).—This is a critical discussion of the so-called three-stage theory or nomad hypothesis of the evolution of agriculture out of the hunting and fishing through the nomadic or herding stages of human industries and of various exceptions which have been made to the theory. A bibliography of works by E. Hahns and others on the subject is given. According to Hahns' formulation man first gathered his vegetable food in the wild state at the same time that he lived by hunting and fishing, later developing the art of cultivating root crops, grains, and grasses at the same time that he learned the domestication of animals. Prominence is given to the religious motive behind agricultural and live-stock production. His critic here points out some fallacies of the latter, but maintains that this agricultural historian has contributed much to many phases of agricultural history.

A new study of the estate regulations of Charles the Great, W. Fleischmann (*Landw. Jahrb., 53 (1919), pp. 1–76*).—The Latin text and German translation of the orders issued by Charles the Great for the organization and administration of the royal estates, defining the duties and remuneration of his executive staff and body of servants, setting forth his choice of crops to be grown, methods of cultivation, and disposal of the products, are given here, with an introduction in which is traced the evolution of large feudal holdings in the early history of the Germanic races, precedents for which are found in Italian

and other Mediterranean countries. An index of plant names and other technical terms which appear is given.

Questions of agricultural tax, SCHLÄGER (*Nachr. Deut. Landw. Gesell. Österr., n. ser., 4 (1920), No. 46–47, pp. 238–243*).—The new Austrian regulations regarding taxes on agricultural income, especially on profits from forest cutting, new exemptions allowed, and the classification of agricultural property for the purpose of tax assessment, are set forth here in minute detail.

The price of agricultural products in France, M. LAIR (*Rev. Écon. Internatl., 13 (1921), I, No. 1, pp. 32–59*).—The author notes the stimulation of consumption of food products brought about by the war and other factors influencing the prices of agricultural products, including decreased production, especially of wheat and meat, marketing difficulties, depreciation of exchange, and a change in the attitude of the rural population.

The women's side of a rural policy, E. B. MITCHELL (*Scot. Jour. Agr., 4 (1921), No. 1, pp. 48–61*).—The report previously noted (E. S. R., 44, p. 893) is reviewed at length.

The church and rural life, LORD BLEDISLOE ET AL. (*London: Soc. Promoting Christian Knowledge, 1920, pp. VIII+56*).—The tone of this report, which was made by a committee appointed by the Archbishop of Canterbury, is best indicated in the words of the terms of reference, "to consider and report upon the ways in which the church may best commend the teaching of Christ to those who are seeking to solve the problems of industrial life in rural areas." The ways in which the church should influence the relationships between the laborers, farmers, and landholders and improve the village homes, recreation, education, and religious life are outlined. In the appendixes are given an excerpt from a report of the proceedings at a meeting in connection with the church tutorial classes movement at Oxford in 1918, and a memorandum on the training of rural clergy in social leadership and suggested outlines of study in connection with the same, by A. W. Ashby, as well as suggestions with regard to village music, by G. Shaw.

What crop rotations show, C. W. MONTGOMERY (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 85–89, fig. 1*).—Certain crop rotations followed on the Clermont County Experiment Farm for the purpose of studying the effect of cropping on the land, and the amount of feed that might be furnished for a dairy herd are described. The yields per acre are tabulated for a number of years, as well as the labor and miscellaneous cost of producing the crops, 1919–1920.

Harvest service project in Kansas, W. BUER (*Kans. Agr. Col. Ext. Circ., 17 (1920), pp. 12, figs. 6*).—Extracts from reports and correspondence dealing with the service in aid of migrant harvest labor groups, inaugurated by the rural service department of the Kansas College, are given here.

The agricultural laborer at home and abroad, A. G. L. ROGERS (*Wages Bd. Gaz., 3 (1921), Nos. 59, pp. 37–40; 63, pp. 112–115*).—A general review is given covering hours, wages, and conditions of agricultural labor in England and other European countries. The development of the idea of labor organization among farm workers is outlined briefly up to the passage of the Corn Production Act, in 1917.

The farm labor problem in Austria after the war and its relation to home colonization projects, E. H. VOGEL (*Arb. Deut. Landw. Gesell. Österr., No. 4 (1920), pp. 163–200*).—A brief historical sketch of the farm labor shortage and migration cityward with industrial development in Austria is given, together with an analysis of the effects of the war in this respect. Certain ways of meeting the situation, such as the increased use of agricultural machinery, the encouragement of labor organization, State encouragement of social insur-

ance, and wage regulations, are suggested; but the main emphasis is put upon the idea of permanent settlement on the land of farm workers. Two types of colonization systems are outlined in technical detail.

Labor conditions in South Africa, R. A. LEHFELDT (*So. African Jour. Sci., 17 (1920), No. 1, pp. 85–95*).—A general discussion of the relative positions of several races making up the population of the Union of South Africa, and especially the fitness or unfitness for agricultural labor of the natives and other inhabitants, is given.

Report of the State Land Settlement Board of the State of California, E. MEAD ET AL. (*Calif. State Land Settlement Bd. Rpt., 1920, pp. 79, figs. 10*).—Progress in the development of the Durham and Delhi settlements from June 30, 1918, to June 30, 1920, is reported here, continuing the previous report (E. S. R., 41, p. 91).

Encouragement by the confederation of home colonization, M. BERNHARD (*Ann. Agr. Suisse, 22 (1921), No. 1, pp. 48*).—A report is made by the Swiss Association for Home Colonization and Industrial Agriculture to the Federal Department of Public Economy defining home colonization, and noting the need for and outlining a proposed plan to improve the land and finance the settlement. The text of a proposed law is given, with comment.

Transportation of wheat (*U. S. Senate, 66. Cong., 2 Sess., Com. Agr. and Forestry Hearings on Transportation of Wheat, 1920, pp. 93, pls. 4*).—The statement of J. H. Barnes before the U. S. Senate Committee on Agriculture and Forestry, investigating the reasons for the embargo on wheat, why transportation was not available to move the wheat of Oklahoma, Kansas, Texas, and Colorado, and other States, and what steps the Grain Corporation had taken to obtain ships for the movement of such grain, is presented here in hearings dated October 25 and 28, 1919. A tabulation of commercial information reported weekly to the U. S. Grain Corporation by grain dealers is given, showing receipts of wheat from farms, shipments, and stocks on hand for the four States in question, and for 11 zones of the United States. Additional tabulations are submitted by the Bureau of Markets of the U. S. Department of Agriculture showing the inspections of wheat, shelled corn, and oats on arrival at Minneapolis and Duluth during the period from July 1 to December 31, 1919. There are also four accompanying charts indicating the cash grain price (high) for certain grades and kinds of wheat, barley, and oats at these two markets. Government prices of wheat in foreign countries, 1919, production of wheat in principal and other countries, 1909 to 1919, and exports of wheat and flour from important surplus producing countries are also shown.

Marketing farm crops, edited by E. L. LUTHER (*Wis. Farmers' Insts. Bul. 33 (1920), pp. 1–80, figs. 50*).—Various practical phases of the subject of marketing as worked out cooperatively among Wisconsin farmers are described in brief articles in this bulletin.

Marketing by federations, T. MACKLIN (*Hoard's Dairyman, 61 (1921), No. 12, pp. 488, 492, 493, 513, fig. 1*).—This is a portion of an anaylsis of a Statewide cooperative cheese marketing enterprise noted from another source (E. S. R., 44, p. 692).

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 8 (1921), No. 45, pp. 8*).—In this number is published the text of the act of 1919 providing for the establishment of standard packages, grades, etc., as well as the usual partial list of products which farmers have for sale.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 4 (1921), Nos. 1, pp. 1–16, fig. 1; 2, pp. 17–32, figs. 2; 3, pp. 33–48, fig. 1; 4, pp. 49–64, figs. 2*).—Abstracts of information of domestic movement, imports and exports, and prices, and brief articles on the situation in the market of specified commodities and

important classes of agricultural products, together with analyses of foreign market conditions, are given in these numbers for the period up to about July 15. In No. 1 is a special review of wheat crops in the principal surplus-producing countries, an analysis of trends of hay prices, and information with respect to stocks of cottonseed meal and cake. No. 2 contains articles describing Chicago as a market for white potatoes and accounting for the anticipated scarcity of feeding cattle. The depressing effect of cull native lambs on the market during June is described, and exports of food products in 1920 are shown to have been above normal, in special articles in No. 3. No. 4 describes the consumption of white potatoes in New York City and the main sources of the supply, also recent reductions in ocean freights on farm products are noted.

Agricultural statistics and agricultural bookkeeping organizations, A. H. HOLLMANN (*Landw. Jahrb., 53 (1919), pp. 361–371*).—In these pages are described the underlying principles and methods of preparation of agricultural statistics in Prussia, Switzerland, and Denmark.

The reform of statistics of acreage and yields, O. WITTSCHIEBEN (*Statis. Mitt., Statis. Landesamt Steiermark, No. 28 (1917), pp. 32*).—This is a report on the investigation of the collection of agricultural statistics in the Province of Styria, Austria, in which in criticizing existing methods the author shows how low are the estimated crop yields arrived at by the multiplication of the estimated yield and area figures. The discrepancy between returns so arrived at and certain actual census figures is variously accounted for. The author favors the restriction of crop reporting to the five food grains—wheat, rye, oats, barley, and corn—and to potatoes. He would have four degrees of crop condition reported, on the basis of which, together with the cultivated area as arrived at for the land register by census questionnaire methods, a reliable figure for the total yield might be given. Tables are drawn up comparing statistical returns for the Province of Styria by the statistical land office and by political authorities.

[Agriculture and agricultural industries in Czecho-Slovakia], compiled by F. POKORNY and P. SELVER (In *The Czechoslovak Republic: Its Economic, Industrial, and Cultural Resources. Prague: Soc. Effort Tchécoslovaquie, 1920, pp. 28–48*).—Statistics relating to agricultural production and agricultural industries for a number of years are given in these pages, with interpretative notes.

Political and agricultural conditions in Asia Minor, G. BUETZ (*Landw. Jahrb., 53 (1919), pp. 515–523*).—Turkish agricultural statistics for 1913, published in 1917, showing the area cultivated and yields of principal grains by subdivisions of Armenia and Anatolia, are reviewed here. Sections where yields of certain crops are high are pointed out.

AGRICULTURAL EDUCATION.

Agriculture in secondary schools (*U. S. Bur. Ed. Bul. 35 (1920), pp. 32*).—This is the report of the committee on agriculture of the commission on the reorganization of secondary education, appointed by the National Education Association. It deals with the aims, content, methods, and materials of courses in farm crops, animal husbandry, poultry, soils, horticulture, farm engineering, and farm management; home projects and local extension work; school exhibits; and the use of reference material. The scope of the instruction described covers the last six years of public-school courses of study.

The development of agricultural education in secondary schools (*Agr. Gaz. Canada, 8 (1921), No. 2, pp. 183–193*).—A series of short articles giving an account of what is being done in Ontario and British Columbia high schools in giving instruction in agriculture. There are in Ontario at present 5 schools

maintaining departments of agriculture and 30 maintaining agricultural classes. In British Columbia agriculture is being taught in 10 high schools in a 2-year course beginning in the second year of the high school, and is usually preceded by a general science course.

The special schools of agriculture (*Agr. Gaz. Canada, 8 (1921), No. 2, pp. 141–150, figs. 5*).—An account is given of special schools of vocational agriculture of less than college grade being developed in Canada. Descriptions are given of the organization and work of the school of agriculture at Kemptville, Ont.; the three new schools of agriculture at Raymond, Gleichen, and Youngstown in Alberta, making a total of six schools for the Province; the Provincial Agricultural and Technical School at Charlottetown, P. E. I.; and the Carleton County Vocational School at Woodstock, N. B.

History and development of the Ontario Agricultural College, C. A. Zavitz (*Sci. Agr., 1 (1921), No. 3, pp. 101–105, figs. 5*).—An account is given of the history and development of the Ontario Agricultural College,which was opened May 1, 1874.

[Agricultural education and research in the Province of Quebec, 1919–20] (*Quebec Min. Agr. Rpt., 1920, pp. XII+227, pls. 26*).—This reports on the activities of the agricultural and household science education institutions, demonstration fields, extension work, etc., under the control of the Quebec Department of Agriculture.

Agricultural teaching in the public schools (*Agr. Gaz. Canada, 8 (1921), No. 2, pp. 193–197*).—This series of short articles gives an account of the present status of agricultural instruction in the elementary schools of Nova Scotia, Saskatchewan, British Columbia, and Manitoba.

Short courses and extension schools: How organized and conducted (*Agr. Gaz. Canada, 8 (1921), No. 2, pp. 172–177*).—Information is given as to the system followed in Ontario, Nova Scotia, New Brunswick, Manitoba, and Saskatchewan in conducting short courses and extension schools.

The home project method of teaching agriculture (*Agr. Gaz. Canada, 8 (1921), No. 2, pp. 198–205*).—This series of articles indicates how home project work is being developed in Ontario, Manitoba, British Columbia, Nova Scotia, and New Brunswick.

Agricultural instruction in the rural schools, F. Callejas (*Rev. Agr., Com. y Trab. [Cuba], 3 (1920), No. 9, pp. 324–330, figs. 2*).—The author presents the text of a circular issued in 1915 by the Board of Superintendents of Public Schools of Cuba, giving general regulations for an outline of a course of instruction in agriculture for the second to the sixth grades, inclusive, of the public rural schools of Cuba. Attention is called to the need of such instruction and of efficiently trained teachers for the purpose.

The sugar school of Havana, A. E. Barthe (*Rev. Agr., Com. y Trab. [Cuba], 3 (1920), No. 9, pp. 330–345, figs. 18*).—This is an account of the organization and work of the Sugar School of Havana, including a detailed description of the course and some results of its work.

[Agricultural and veterinary education] (*India [Dept. Agr.] Rev. Operations, 1919–20, pp. 66–72, 96–98, 115–120, 125*).—This is a brief survey of the principal agricultural education activities in India in 1919–20, comprising the work of one postgraduate training institution, six agricultural colleges, two agricultural middle schools in the Central Provinces, six vernacular agricultural schools in Bombay, three vernacular schools in Bengal, four veterinary colleges, and two veterinary schools. Lists of the agricultural and veterinary colleges and schools, together with attendance and data on courses of study, are included.

Vocational homemaking education: Some problems and proposals, D. SNEDDEN ([*Columbia Univ.*] *Teachers Col. Rec., 20 (1919), No. 5, pp. 407–440*).—A reprint of the chapter on vocational homemaking education in the book previously noted (E. S. R., 45, p. 193).

Household mechanics, J. H. TRYBOM (*Indus. Arts Mag., 10 (1921), No. 5, pp. 174–176*).—This is a statement of the contents of the household mechanics' course offered in the seventh or eighth grades of Detroit schools, together with lists of the necessary equipment.

Vocational arithmetic for girls, N. S. DAVIS (*Milwaukee, Wis.: Bruce Pub. Co., 1920, pp. 137, figs. 23*).—This text has been developed so that the general sequence is constant with the vocational problems. It embraces a two-year course including trade, food, sewing, and home economics problems.

A study of the factors in the efficiency of boys' and girls' clubs, W. W. CHARTERS and J. H. GREENE (*School Sci. and Math., 21 (1921), No. 4, pp. 335–341*).—This is a discussion of statistical studies of boys' and girls' clubs in Illinois, made in 1917 and 1918 for the purpose of determining the effect upon the actual efficiency of the clubs of the local leader, the advisory committee, club officers, meetings, paid club leaders, the size of the club, making reports and exhibits, and the age distribution of clubs. It is concluded that the personality of the leader probably is of more importance than any other single item, and that has not been measured in this investigation.

MISCELLANEOUS.

Thirty-first Annual Report of Arizona Station, 1920, D. W. WORKING ET AL. (*Arizona Sta. Rpt. 1920, pp. [4]+425–484, figs. 5*).—This contains the organization list, an administrative report on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1920, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 295 (1920), pp. [2]+217–236+XII*).—This contains the organization list of the station; abstracts of four papers previously noted; meteorological observations noted on page 418; a financial statement for the fiscal year ended June 30, 1920; an index to Bulletins 285–295, inclusive, which collectively constitute the thirty-sixth report of the station; a combined index to the reports from 1916–1920 and to Bulletins 246–295, inclusive; and announcements as to the work, publications, and equipment of the station.

Forty-third Annual Report of North Carolina Station, 1920, B. W. KILGORE ET AL. (*North Carolina Sta. Rpt. 1920, pp. 69*).—This contains the organization list, a report of the director and heads of departments, and a financial statement for the year ended June 30, 1920. The experimental work is for the most part abstracted elsewhere in this issue.

Twenty-ninth Annual Report of Oklahoma Station, 1920, H. G. KNIGHT ET AL. (*Oklahoma Sta. Rpt. 1920, pp. 64, figs. 17*).—This contains the organization list, reports by the director and heads of departments, a meteorological summary, a special article, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Porto Rico Insular Station, 1920, E. D. COLON ET AL. (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1920, pp. 101*).—This contains the organization list, a report by the director for the fiscal year ended June 30,

1920, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Thirtieth Annual Report of Wyoming Station, 1920, A. D. FAVILLE ET AL. (*Wyoming Sta. Rpt. 1920, pp. 115–143*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, reports of the director and heads of departments, and meteorological observations. The experimental work reported is for the most part abstracted elsewhere in this issue.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 3 (1921), No. 3, pp. 75–112, figs. 11*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Livestock Production in 1921, by G. A. Brown; Raising Dairy Calves, by J. E. Burnett; Dependable Crop Varieties, by J. F. Cox and D. Rainey; Sugar Beet Suggestions, by J. F. Cox; Sugar Beet Seed Production, by E. E. Down and F. A. Spragg; Annual White Sweet Clover, by J. F. Cox, F. A. Spragg, and E. E. Down; High Yielding Soy Bean Varieties for Michigan, by C. R. Megee; Treble Superphosphate, by M. M. McCool; Farm Records and Accounts, by H. M. Eliot; Tree Repair Work, by P. L. Buttrick; Inoculation of Legumes, by R. M. Snyder; Honey and Maple Sirup Vinegar, by Z. N. Wyant; and a list of available bulletins.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 6 (1921), No. 5–6, pp. 65–95, figs. 7*).—This number contains, in addition to several articles abstracted elsewhere in this issue, the following: Official Records in the Ohio Station Dairy Herds, by C. C. Hayden, and Answers to Timely Questions.

Bimonthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 3, pp. 33–48, figs. 5*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Weed Treatments, by M. E. McCollam; Brief Culling Instructions for June, July, and August, by Mrs. G. R. Shoup; Midsummer Feeding Problems, by H. E. McNatt; and Notes on Pig Feeding, by W. A. Linklater.

Farms follow stumps, H. L. RUSSELL (*Wisconsin Sta. Bul. 332 (1921), pp. 35, figs. 18*).—Progress made in the development of the cutover areas in northern Wisconsin following the establishment of substations in the region since 1909 is briefly set forth. Results of experimental work referred to are for the most part abstracted elsewhere in this issue.

NOTES.

Alabama College.—*School and Society* notes that Dr. C. C. Thach, president emeritus since 1920 and president of the college for 28 years, died October 3 at Dalton, Ga., aged 71 years.

Arizona University and Station.—J. J. Thornber, professor of botany and botanist, succeeded Dean and Director D. W. Working September 1 as director of the station.

Arkansas University and Station.—Dwight Iseley, scientific assistant in the Bureau of Entomology, U. S. Department of Agriculture, has been appointed associate professor of entomology and associate entomologist in the station.

California University and Station.—Dr. H. J. Webber has returned to the institution as professor of citriculture and director of the Citrus Experiment Station at Riverside, and will have charge of instructional and investigational work in citriculture at both places.

Kansas College and Station.—A strain of Fulghum oats, with which the station has been experimenting for six years and which has proved to be decidedly superior to any of the varieties commonly grown in the State, has been named Kanota. About 600 bu. of seed of this strain was distributed in the spring of 1921 for testing throughout the State in cooperation with the State Crop Improvement Association. The strain has shown marked superiority in yield, earliness, test weight, and resistance to late spring freezes.

A summary has been prepared of the results secured during 1920 in the farm organization and cost of production survey which is being carried on in Jackson County by the statistical route method. The cost of production per bushel of corn ranged from 45 cts. to $1.14, averaging 64.2 cts.; wheat from $1.27 to $2.85, averaging $1.77; and oats from 53 cts. to $2.02, averaging 75.7 cts. With alfalfa the cost ranged from $5.98 to $26.22 per ton, averaging $11.12; and with pork from $6.55 to $32.60 per hundredweight, averaging $13.08. The cost per hour of horse labor ranged from 9.9 cts. to 31.8 cts., averaging 18.5 cts.

H. L. Kent, superintendent of the Fort Hays Substation, has resigned to become president of the New Mexico College, and has been succeeded by L. C. Aicher, superintendent of the Aberdeen Substation, Idaho, in cooperation with the Office of Cereal Investigations, U. S. Department of Agriculture. Other appointments include N. E. Olson as associate professor of dairy husbandry in charge of dairy manufactures, W. V. Lambert as fellow in animal husbandry, Richard P. White as assistant in plant pathology, and Joseph F. Merrill and J. C. Jenkins as assistant chemists.

Louisiana University and Stations.—Dr. W. H. Dalrymple has resigned as dean and director on account of impaired health. Dr. W. R. Dodson, retired, has been reappointed to these positions and assumed charge October 10.

Michigan College.—David Friday, professor of economics and finance in the University of Michigan, has been appointed president, beginning January 1, 1922, Dean R. S. Shaw serving as acting president until that time. Dr. F. S. Kedzie, the retiring president, has been appointed dean of the new department of applied sciences.

Montana College and Station.—F. M. Harrington, professor of pomology at the Iowa College, has been appointed professor of horticulture and station

horticulturist, beginning September 1. P. V. Cardon resigned as head of the agronomy department June 30, and was succeeded September 1 by Clyde McKee, associate professor of farm crops at the Iowa College.

New Mexico Station.—On August 10 about 150 Dona Ana County farmers visited the station. The meeting had been well advertised by the extension division, as it was felt that if the farmers would spend a few hours at the station they could obtain a better idea of the investigational work that was in progress than they would probably be able to secure in any other manner. Many of them brought their lunches and spent most of the day in going over the various projects in the laboratories and fields.

North Dakota College.—Dr. J. L. Coulter, dean of the College of Agriculture of the West Virginia University and director of the West Virginia Station, has been appointed president, vice Senator E. F. Ladd, resigned, and entered upon his new duties in September.

Ground will be broken during the year for the new agricultural building, a three-story structure to house the school of agriculture and the extension department.

New courses in agricultural education and poultry husbandry are being offered. The work in agricultural education will be in charge of E. H. Jones, superintendent of the State agricultural school at Park River, as professor of agricultural education, vice P. J. Iverson, and that in poultry husbandry will be under the direction of O. A. Barton as head of the department of poultry husbandry. Dr. Robert T. Hance of the University of Pennsylvania has been appointed professor of zoology and physiology, vice Dr. A. L. Leathers.

Ohio State University.—The board of trustees has authorized the establishment within the college of agriculture of the Plant Institute of the university, an organization for furthering research with plants. All members of the college staff interested in plant studies may be members, and all graduate students doing their major work with plants are associate members. The institute will conduct a weekly seminar, review the work of its graduate students, and encourage research, especially the study of such problems as require cooperation. The departments of the college chiefly concerned are those of botany, horticulture, farm crops, agricultural chemistry, and soils.

Ohio Station.—Under a general plan of reorganization of all of the administrative activities of the State, the legislature at its last session placed the station under a new board of control, consisting of seven trustees of the Ohio State University and the directors of agriculture. The latter is a member of the governor's cabinet, having charge of the work formerly cared for by the secretary of agriculture. At the August meeting of the new board, C. G. Williams was appointed director of the station, G. Bohstedt, assistant professor of animal husbandry of the Wisconsin University and Station, chief of the department of animal industry, and W. J. Young assistant in botany. The other heads of departments were reappointed.

Oklahoma College and Station.—The dairy barn is nearing completion, and a few purebred Jersey cows have been bought. This will increase the dairy herd sufficiently to enable the beginning of experimental work in a small way on dairy production.

On July 1, Dr. M. A. Beeson was appointed dean of agriculture, Dr. C. T. Dowell director of the station, and W. A. Conner director of extension work. W. A. Radspinner was appointed assistant professor of horticulture beginning September 1, vice C. W. Rapp, resigned, and W. E. Jackson assistant professor of entomology beginning September 15, vice Otis Wade, resigned.

South Carolina Station.—New appointments, effective July 1, are announced as follows: L. E. Tisdale as assistant State pathologist in crop pest and disease

work; W. D. Salmon as assistant animal husbandman to take up experimental work with hogs and beef cattle; I. R. Jones as assistant dairyman, vice W. W. Gordon; A. M. Musser as assistant horticulturist, to assist in horticultural investigations and carry on cooperative experimental work with truckers and fruit growers in the eastern part of the State; and G. H. Aull as assistant to the director.

Tennessee University and Station.—Beginning July 1, G. M. Bentley, associate entomologist, was transferred entirely to instruction work.

Texas Station.—Dr. G. F. Freeman, formerly of the Arizona Station and for nearly three years cotton breeder for the Société Sultanienne d'Agriculture at Cairo, has returned from Egypt, and has taken up work at this station as chief of the division of cotton breeding. J. L. Lush, Ph. D. (University of Wisconsin, 1921), has accepted a position in the division of animal industry as animal husbandman in charge of animal genetics work. The resignations are noted of W. Walker as assistant chemist on August 31, and Roy A. Brewer as assistant animal husbandman in sheep and goat investigations on September 30.

The degree of doctor of philosophy was conferred upon Director B. Youngblood by the University of Wisconsin at its recent Commencement, the title of his thesis being An Economic Study of Ranching in the Edwards Plateau of Texas.

U. S. Department of Agriculture.—Charles W. Pugsley, formerly of the Nebraska University and Station and subsequently editor of the *Nebraska Farmer*, has been appointed Assistant Secretary of Agriculture, beginning October 1. On the same date Dr. E. D. Ball became Director of Scientific Work, a new position established under the last appropriation act. It is announced that for the present the Assistant Secretary will be specially charged with the general supervision of the extension and publication work of the Department, with such other duties as are required by law or may be assigned from time to time. The Director of Scientific Work will have general supervision of scientific research as regards personnel, plans and project outlines, the coordination and correlation of the scientific work with the view of directing it toward the solution of national agricultural problems involving more than one field of effort, and the selection of scientific manuscripts for publication, advising with the Assistant Secretary as to the manner of publication.

In the States Relations Service, the Offices of Extension Work in the North and West and Extension Work in the South were combined on October 1 as the Office of Extension Work. Dr. C. B. Smith, chief of the former office, has been appointed in charge.

George M. Rommel, chief of the animal husbandry division, Bureau of Animal Industry, has resigned, effective November 1, to accept a position with a publishing house in New York City as editor-in-chief of several of its publications, including *The Field Illustrated and System on the Farm*, *El Campo Internacional*, and *The Field Year Book*.

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EXPERIMENT STATION RECORD.

VOL. 45. ABSTRACT NUMBER. No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The chemistry of plant life, R. W. THATCHER (*New York: McGraw-Hill Book Co., Inc., 1921, pp. XVI+268*).—This textbook has been developed from a series of lectures in connection with a course of phytochemistry at the University of Minnesota. The material covered has been arranged in such a way as to proceed from simple chemical substances to those of more complex structure as shown by the chapter headings, which are as follows: Plant nutrients; organic components of plants; photosynthesis; carbohydrates; gums, pectins, and celluloses; glucosids; tannins, pigments, organic acids, acid salts, and esters; fats and oils, waxes, and lipoids; essential oils and resins; the vegetable bases; proteins; enzyms; the colloidal condition; the physical chemistry of protoplasm; hormones, auximones, vitamins, and toxins; and adaptations.

Animal and vegetable oils, fats, and waxes, G. MARTIN (*London: Crosby Lockwood & Son, 1920, pp. X+218, pls. 7, figs. 75*).—This volume deals with modern methods for the extraction, refining, and analysis of animal and vegetable oils, with special attention to the recovery of oil from waste materials of all sorts and to the hydrogenation of oils. A chapter on the recovery of oil from metal turnings and waste rags, etc., in engineering shops is contributed by E. A. Alliott.

A biochemical study of copra meal, F. O. SANTOS Y ALVAREZ (*Philippine Jour. Sci., 16 (1920), No. 2, pp. 181–189*).—Analyses of copra meal are reported as follows: Proximate analysis, moisture 11.3, oil 12.2, crude protein 20.1, ash 5.5, crude fiber 13.2, and carbohydrates 37 per cent; distribution of nitrogen in the portion of the meal insoluble in hot water, amid 25.72, humin 7.11, cystin 6.58; arginin 11.73, histidin 3.94; lysin 2.19, mono-amino 41.96, and nonamino 2.08 per cent. These figures indicate that copra, while poor in lysin, is rich in arginin, histidin, and cystin. Preliminary feeding experiments indicate that when fed alone it can not produce growth in hogs, but when fed with green leaves it forms a fairly good feed.

A study of the solubility of the protetins of copra meal in different solvents is also reported. The alkali-soluble protein proved most abundant, followed by water-soluble and salt-soluble fractions. Almost no alcohol-soluble protein was obtained.

Distribution of nitrogen in the alfalfa seed, H. G. MILLER (*Jour. Amer. Chem. Soc., 43 (1921), No. 4, pp. 906–913*).—Determinations of the nitrogen distribution in alfalfa seed reported from the Oregon Experiment Station include percentages of nitrogen extracted from the seed by various solvents; ele-

mentary analyses of the protein of the seed obtained by extraction with 0.5 per cent KOH, precipitation of the carbohydrates, etc., with alcohol, and subsequent precipitation of the protein from the alcoholic solution by dilute acetic acid; and analyses by the Van Slyke method of the protein thus obtained and of the hydrolysis products of the whole seed. The percentages of the different fractions found in the products of the hydrolysis of the whole seed and of the isolated protein were, respectively, as follows: Amid N 7.43 and 8.67 per cent, humin N adsorbed by magnesia 6.53 and 4.22, humin N insoluble in amyl alcohol 2.02 and 0.19, humin N soluble in amyl alcohol 4.98 and 0.52, arginin N 14.98 and 21.38, histidin N 6.75 and 5.42, lysin N 8.11 and 6.11, cystin N 0.60 and 1.01, amino N of filtrate 43.80 and 47.87, and nonamino N of filtrate 5.56 and 5.32.

The relation of lactic acid bacteria to corn silage, E. B. Fred, W. H. Peterson, and J. A. Anderson (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 319–327*).—This paper reports the results of a study at the Wisconsin Experiment Station of the effect of inoculation on the composition of silage, together with a study of the normal flora of green corn and of silage. Experiments were conducted both on a large scale in 8 by 4 ft. tanks and on a smaller scale in 50-gal. barrels. The organisms tested included those of the *Lactobacillus pentoaceticus* group, *Bacillus lactis acidi*, and *B. bulgaricus*. The silage was made from corn with ears well matured, but with stalks and leaves still green. This was inoculated with 5 liters of a 48-hour culture of the organism to each ton of fodder. Bacteriological and chemical analyses of representative samples of the silage were made at varying intervals.

The inoculation of the silage, regardless of the types of bacteria used, resulted in a slightly lowered production of volatile acid. The *L. pentoaceticus* organisms brought about an increase in alcohol and a decrease in nonvolatile acids, while mixed cultures of lactic-acid organisms produced the opposite effect. Practically the same results were obtained in the barrel silage as in the large containers.

The bacteriological studies showed a large variety of forms in the fresh green corn, gradually diminishing until after 12 days the *L. pentoaceticus* type began to predominate. Inoculation with this organism caused it to predominate earlier than in the uninoculated silage, but in both the final examination after 8 to 10 weeks showed that the *L. pentoaceticus* type formed 50 per cent or more of the flora. The authors conclude that while inoculation may hasten and intensify the production of certain products during the early stages of the fermentation, uninoculated and inoculated silage in the latter stages show approximately the same chemical composition and the same kinds of microorganisms.

The destruction of pentosans in the formation of silage, W. H. Peterson, E. B. Fred, and J. H. Verhulst (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 329–338*).—Determinations of the pentosans in the silage obtained at various intervals in the above study are reported.

While the total amount of pentosans in the green fodder was about 21.8 per cent, at the end of 50 days the percentage was found to range from 17.6 to 20.9, the variation being partly due to variations in loss of dry matter. Assuming a loss of 10 per cent of dry matter, it is calculated that from 15 to 20 per cent represents the minimum loss of pentosans in the fermentation of corn silage. Pentoses or other furfural-yielding substances, soluble in water, were found to be present in the silage throughout the fermentation. The production of these substances is thought to be due to the action of the microorganisms in the silage.

Photometric methods and apparatus for the study of colloids, S. E. Sheppard and F. A. Elliott (*Jour. Amer. Chem. Soc., 43 (1921), No. 3, pp. 531–539, figs. 10*).—Two types of photometer, distinguished as vertical and horizontal types, for the study of colloids are described and illustrated. The vertical plane type can be modified for use as a nephelometer, colorimeter, microphotometer, dispersimeter, and turbidimeter, while the horizontal type is used particularly for determining particle size, comparative turbidities, and coagulation velocities.

A colorimetric method for determining the H-ion concentration of small amounts of fluid, L. D. Felton (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 299–305, fig. 1*).—A colorimetric method of determining H-ion concentration in single drops of fluid is described. Indicators of the Clark and Lubs series were used, both singly and in certain combinations, to give a wider range of pH value as follows:

Thymol blue and bromphenol blue between pH=1.2 and 4.6, methyl red and bromthymol blue from pH=4.6 to 7.6, and methyl red and bromcresol purple from pH=4.6 to 7. Methyl red, bromcresol purple, phenol red, and cresol red are used in 0.01 per cent solution in 25 per cent alcohol, and thymol blue, bromphenol blue, and bromthymol blue in 0.2 per cent solution. The combined indicators are made by mixing equal parts of a double-strength indicator solution. The method consists in mixing a drop of the fluid to be tested with a drop of an appropriate indicator, noting the color, and then placing in close proximity drops of several buffer solutions that are judged to be the same color. The pH value is determined from the buffer mixture giving the same color tint.

A study of the variations in H-ion concentration of broth media, L. F. Foster and S. B. Randall (*Jour. Bact., 6 (1921), No. 2, pp. 143–160*).—The principal changes in H-ion concentration of broth media occurring during autoclaving and on standing, as determined colorimetrically, were found to be as follows:

Broth adjusted to pH values ranging from 5 to 9 underwent changes in H-ion concentration which were most marked in media adjusted in the alkaline range (7.8 to 9), less great in the acid range (5 to 6.2), and usually inappreciable in the neutral range (6.6 to 7.4). The change, in general an increased acidity, was in the majority of cases not over 0.2 pH and never over 0.4 pH. The reaction changes were not necessarily uniform in media of the same composition in different experiments. Similar changes were found to take place in autoclaved media on standing, the change being almost invariably in the direction of an increase in acidity. That this was not due to adsorption of atmospheric CO_2 was shown by the fact that the same reaction changes were noted in duplicate lots of broth allowed to stand in an atmosphere of CO_2 and in the air. No relation was found to exist between the reaction changes and changes in formol-titration nitrogen.

These results are thought to lend support to the suggestion of Robertson that the increase in acidity of broth is due to the taking up of -COHN- groups during hydrolysis of the protein constituents.

Phthalate buffers—some incompatibilities, H. F. Zoller (*Jour. Amer. Chem. Soc., 43 (1921), No. 4, pp. 914–916*).—Attention is called to certain phenomena associated with the conduct of buffer mixtures containing phthalic acid. Of particular importance in biological studies is the reaction between albumin and phthalates. Potassium phthalate was found to lower noticeably the coagulation temperature of lactalbumin and egg albumen. Since the isoelectric points of most of the body proteins and amino acids exist in the range of H-ion concentration covered by the phthalate series, it is thought that the use

of phthalate buffers in locating roughly the iso-electric points of proteins may lead to error.

Phthalic anhydrid derivatives.—A partial collection of names and references, M. PHILLIPS (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 247–249*).

The iodometric determination of the diastatic power of malts, J. L. BAKER and H. F. E. HULTON (*Analyst, 46 (1921), No. 540, pp. 90–93*).—The iodometric method for the estimation of sugar (E. S. R., 45, p. 112) has been found practical for determining the diastatic capacity of malts as follows:

One, 2, or 3 cc. of the extract is allowed to act for 1 hour at 21° C. on 100 cc. of 2 per cent soluble starch, after which the action is stopped by adding 10 cc. of N/10 NaOH, the solution diluted to 200 cc., and 50 cc. of the conversion products transferred to a wide-mouthed, stoppered vessel. To this is added 20 cc. of N/10 iodin solution, followed by 30 cc. of N/10 NaOH. After standing for 10 minutes at air temperature, the solution is acidified with 4 cc. of N H_2SO_4 and the excess iodin found by titrating with N/10 sodium thiosulphate solution. The diastatic capacity is calculated from the formula: D. P.$=\frac{16.7\ Y}{X}$, where Y=cc. of N/10 iodin used in oxidizing the maltose and X=cc. of 5 per cent malt extract originally taken for the conversion . The method can not be used if any reducing sugar other than maltose is formed in the course of the reaction.

The use of edestin in determining the proteolytic activity of pepsin, J. F. BREWSTER (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 119–127, fig. 1*).—The author at the Bureau of Chemistry, U. S. Department of Agriculture, suggests the use of purified edestin for determining the proteolytic strength of pepsin. The technique for the preparation of the edestin and for the method of pepsin assay is described in detail.

Comparative results with Scales' method and Devarda's alloy for reducing nitric nitrogen, A. P. HARRISON (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 53–56*).—A comparison is reported of the Scales procedure for determining nitric nitrogen with a zinc-copper couple as a reducing agent (E. S. R., 36, p. 504) with the Devarda method as modified by Snyder and Potter.[1] The original Scales procedure was modified by using slightly different proportions of the sodium chlorid-magnesium oxid mixture (5:1.5) and by using the ordinary Kjeldahl block tin condenser instead of special apparatus. The distillate was collected in boric acid as recommended by Scales and Harrison (E. S. R., 42, p. 802).

In a series of 10 determinations on sodium nitrate, the results obtained by both methods were practically identical. The zinc-copper method is recommended in preference to the Devarda as more convenient and rapid, since no weighing of reagents is necessary.

Centrifugal method for determining potash, E. SHERRILL (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 227, 228*).—For the method described a special potash centrifuge tube is required which is similar to the ordinary Babcock milk test bottle inverted, with the stem sealed and the bottom cut out. The solutions used in the determination are a standard K_2O solution, a specially prepared solution of sodium cobaltic nitrite, and a 10 N solution of NaOH. The standard K_2O solution is prepared by dissolving 15.83 of highest purity KCl in distilled water in a liter volumetric flask, adding 8 or 10 drops of C. P. glacial acetic acid, diluting to the mark, and mixing thoroughly. The sodium cobaltic nitrite solution is prepared by mixing a solution of 450 gm. of

[1] Soil Sci., 6 (1918), No. 6, pp. 441–448.

C. P. sodium nitrite in 800 cc. of water with a solution of 250 gm. of C. P. cobalt acetate in 800 cc. of water, and diluting the whole to 2 liters. Several hours before using, 65 cc. of water and 5 cc. of glacial acetic acid are added to 100 cc. of the stock solution. The technique is as follows:

Five cc. of an approximately 1 per cent K_2O solution of the sample is transferred to a potash centrifuge tube containing 17 cc. of the sodium cobaltic nitrite solution. To a similar tube is added 5 cc. of the standard K_2O solution. Both are centrifuged in a Babcock milk test hand centrifuge at 1,000 revolutions per minute. The tubes are removed, tapped gently to level the surface of the precipitate, and centrifuged again for 15 seconds. The results are calculated by the formula:

$$\frac{\text{Cc. to which sample is diluted} \times \text{reading of sample}}{\text{Gm. of sample in above solution} \times \text{reading of standard}} = \text{per cent } K_2O.$$

New method for the determination of potassium in silicates, J. J. Morgan (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 225–227*).—The technique of the proposed method is as follows:

From 0.3 to 0.6 gm. of the silicate is decomposed by digesting at room temperature with an excess of hydrofluoric acid and the excess removed by evaporating to dryness at low temperature on a sand bath. About 25 cc. of 3 N HCl is added, the mixture warmed until all but a small amount of CaF_2 is dissolved, an excess (10 cc.) of 10 per cent perchloric acid added, and the evaporation continued on a sand bath until dense white fumes of perchloric acid are obtained. The evaporation is then continued to dryness by heating over night on an electrically heated and regulated sand bath. The residue is taken up with hot water, 1 or 2 cc. of 10 per cent perchloric acid is added, and the evaporation to dense white fumes repeated. This process is repeated until the residue is completely soluble in hot water. After cooling the final residue, it is treated with about 20 cc. of alcohol wash (97 to 98 per cent alcohol containing 1 cc. of 60 per cent perchloric acid per 300 cc.) and digested with frequent stirring for about 15 minutes. The cold solution is finally decanted through asbestos in a Gooch crucible, and the potassium perchlorate is washed by decantation and in the crucible with small portions of the alcohol wash. The precipitate of $KClO_4$ is dried for at least 30 minutes at about 130° C.

Different methods of determining manganese and their utility in the examination of the ash of plants and similar products, D. H. Wester (*Rec. Trav. Chim. Pays-Bas, 39 (1920), No. 5, pp. 414–422; abs. in Chem. Abs., 14 (1920), No. 17, pp. 2595, 2596*).—A critical review is given of different methods of determining small amounts of manganese such as are found in plant ash. The colorimetric determination by the persulphate method is considered the most suitable, particularly on account of the fact that small amounts of acids and salts do not interfere with the reaction and that the determination can be made in special colorimetric tubes which can be closed to prevent loss of material. This method is, however, not considered applicable to the analysis of soils.

A method of purifying certain kinds of proteins, A. M. Field (*Jour. Amer. Chem. Soc., 43 (1921), No. 3, pp. 667, 668*).—The method suggested depends upon the principle that any protein with an isoelectric point at an H-ion concentration greater than that of water will lose any combined basic elements when dialyzed against dilute acids and at an H-ion concentration less than that of water when dialyzed against dilute bases. Under the first conditions the resulting acid protein can be purified by hydrolysis and subsequent dialysis with water, and under the second by treatment with alkali fol-

lowed by water. The technique of the suggested method as applied to gelatin is described.

The application of the Van Slyke method to hydrolyzed protein extracts of silage crops, R. E. NEIDIG and R. S. SNYDER (*Jour. Amer. Chem. Soc., 43 (1921), No. 4, pp. 951–959*).—This contribution from the Idaho Experiment Station consists of a study of the applicability of the Van Slyke method of determining amino acids in proteins to the analysis of silage crops before and after ensiling. A few analyses were made by the Van Slyke method as used by Grindley et al. (E. S. R., 33, p. 805) and the rest by the modification of this method as described by Eckstein and Grindley (E. S. R., 40, p. 510). Nitrogen was also determined in the ether and alcohol extracts. In some of the legume silages a large amount of nitrogen was found in these extracts, particularly in the alcohol extract of silage made from peas and from alfalfa. In silage made from legumes mixed with grains the amount of nitrogen in the ether and alcohol extracts was much less than in either the legume or grain silage alone. A considerable amount of the nitrogen in the extracts was in compounds yielding ammonia when aerated from an alkaline solution. The fact that the original crop before ensiling did not show any appreciable amount of nitrogen in the ether and alcohol extracts is thought to be a further indication that slight changes take place in the proteins during silage formation.

A comparison of the results obtained by the old and new method showed a slight lowering of humin nitrogen in the results obtained by the new method. The total nitrogen of the bases was slightly less in crops after ensiling, but no relation could be observed in the amounts of the individual bases before and after ensiling. The amount of lysin was sometimes larger and sometimes smaller in the silage than in the original. In almost all cases the percentage of total nitrogen was below 100. "The results, it appears, do not warrant the hope that the protein of forage crops, containing such a large quantity of cellulose which it is impossible to remove, can be successfully analyzed by the Van Slyke method. It is believed, however, that in such concentrates as contain but little cellulose a fair interpretation of the protein molecule can be secured when analyzed by the new method of Eckstein and Grindley."

Methods of analysis [of wheat flour] (*Amer. Inst. Baking Bul. 2 (1921), pp. 35*).—This publication reports the results of cooperative work during 1920 on the analysis of wheat flour. Three samples of flour from different varieties of wheat were sent to each of 28 laboratories representative of leading bakeries, mills, experiment stations, and consulting and food-control laboratories and there analyzed for moisture, ash, protein (total nitrogen×5.7), and gluten, each laboratory using its own methods under the usual working conditions.

The data reported show wide differences, largely the result of the choice of method. Recommendations made as the result of an examination of these data include the elimination of nonuniform air-drying methods and the adoption of drying in vacuo according to the standard procedure of the Association of Official Agricultural Chemists, the use of platinum or vitreosil dishes in ash determinations, a further study of the determination of gluten, and the adoption of some standard expression for the physical qualities of the gluten. The more general use of the Official methods (E. S. R., 44, p. 9) by all engaged in the examination of cereal products is strongly urged.

The cryoscopy of milk, J. HORTVET (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 198–208, fig. 1*).—This paper, which was presented at the 1920 meeting of the Association of Official Agricultural Chemists at Washington, D. C. (E. S. R., 44, p. 99), consists of a comprehensive summary of the literature on the subject, a description with illustration of the cryoscope designed by

the author, and detailed directions for the determination and the results of the application of the method to unadulterated samples of milk, samples of known added water content, and various market samples. The author is of the opinion that, with the method of standardized as described, "the cryoscopic test is reliable as a method for the determination of added water in amounts far below 10 per cent. When the freezing point of the original whole milk is known results are obtainable to within an error not far from 0.5 per cent, and when the freezing point of the original milk (e. g., a herd milk) is unknown the addition of water may safely be reported in an amount as low as 3 per cent."

Rapid acidity test for grading milk handy in warm weather, R. H. SHAW (*West. Milk Dealer and Dairyman, 4 (1921), No. 12, pp. 285, 286*).—This test, devised at the Dairy Division, U. S. Department of Agriculture, for use in creamery receiving rooms, requires two small dippers of the same capacity, one for measuring the milk and the other the special alkali solution, which is prepared by diluting to 1 liter with distilled water 50 cc. of a special stock solution containing 17.777 gm. NaOH per liter. This dilution is of such strength that unit volumes of it and milk of 0.22 per cent acidity will exactly neutralize each other. Consequently on mixing in a porcelain dish a dipperful of the milk with a few drops of phenolphthalein and a dipperful of the sodium hydroxid solution the milk will remain pink if it is less than 0.2 per cent acidity and become colorless if it is of an acidity of 0.2 per cent or more. By changing the dilution of the alkali solution the test can be used to check any percentage acidity desired.

Coconut water, its characteristics, composition, and various uses, A. LAHILLE (*Bul. Écon. Indochine, n. ser., 23 (1920), No. 140, pp. 1–25, pls. 4, fig. 1*).—Analyses are reported of coconut water, and its use as an adulterant of milk and medicinally as a diuretic are discussed. Potassium is believed to occur in the milk as potassium nitrate and chlorid. Contrary to the results of de Kruyff (E. S. R., 20, p. 65), sucrose was not found in the juice of the young nuts, but only reducing sugars.

The sugar of the blood, J. J. R. MACLEOD (*Physiol. Rev., 1 (1921), No. 2, pp. 208–238, figs. 4*).—Following a brief review of the principles of the methods used for estimating blood sugar and a comparison of their relative degrees of accuracy, the author discusses the distribution of the blood sugar between corpuscles and plasma, its concentration in the normal animal before and after taking food, and the alterations in concentration in disease with their significance in diagnosis and treatment. A bibliography of 65 titles is appended.

A clinical method for the quantitative estimation of calcium in blood, M. KAHN and L. G. HADJOPOULOS (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, p. 200*).—A rapid method of determining the calcium content of blood, which is said to give remarkably uniform results, is described as follows:

To 1 cc. of the blood serum in a 10 cc. test tube is added 4 cc. of a 1 per cent solution of ammonium oxalate. After standing for one-half to 1 hour the mixture is centrifuged, the supernatant liquid poured off, and the precipitate washed three times with distilled water and again centrifuged. The sediment is transferred with a little distilled water to a vitreosil crucible, the water slowly evaporated, and the precipitate heated in a strong flame until changed to CaO. The ash is dissolved in 0.5 cc. N/50 HCl, 1 cc. distilled water added, and the excess HCl titrated with N/100 NaOH, using phenolphthalein as indicator.

A clinical method for the quantitative determination of potassium in small amounts of serum, B. KRAMER and F. F. TISDALL (*Jour. Biol. Chem., 46*

(1921), No. 2, pp. 339–349).—By adjusting to pH=5.7 the H-ion concentration of the sodium-cobaltic nitrate reagent used in the determination of potassium in ashed blood (E. S. R., 42, p. 506), it has been found possible to precipitate quantitatively the potassium from unashed blood while the proteins remain in solution. The precipitate is centrifuged, washed repeatedly with water, and then titrated as in the usual method.

The determination of inorganic phosphate in urine by alkalimetric titration, C. H. FISKE (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 285–295, figs. 2*).—The method described involves the titration on a small scale of the magnesium ammonium phosphate precipitate. One of the features of the method is the use of a special filtration tube, consisting of a glass tube about 8 mm. in internal diameter and 120 mm. long, constricted at the lower end to a bore of 2 mm., and flanged at the upper end. This tube is supported by a rubber stopper in the neck of a suction flask large enough to contain a 50 cc. test tube, and provided with a thin mat of paper pulp. The device makes it possible to filter and wash small precipitates very rapidly, and to transfer the washed precipitate through the hole in the lower end to a flask for titrating. The final titration is conducted with N/10 NaOH from a micro-burette provided with an accessory tip. The technique of the method is described in detail.

A test for annatto in fats and oils, W. BRINSMAID (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 216, 217*).—A modification of the usual test for annatto in butter, oleomargarin, etc., is described.

The melted, filtered fat is shaken with equal quantities of chloroform and 5 per cent NaOH solution and allowed to stand for several minutes on the water bath at 50 to 60° C., after which a little of the broth is removed to a beaker and dilute NaOH added, together with sufficient filter paper, previously disintegrated in water, to take up the coloring matter. The whole is allowed to stand on the steam bath with frequent stirring until the annatto has been absorbed by the paper pulp. It is then filtered with light suction on a Gooch crucible containing a small disk of paper, and a few drops of $SnCl_2$ are applied, a clear pink color resulting in the presence of annatto. The chief advantage of the test is the separation of the annatto from the oil, thus making it more easily absorbed by the filter paper.

General classification for facilitating the identification of coloring matter derived from coal (*Ann. Falsif., 13 (1920), No. 141, pp. 193–456*).—This is a scheme for the classifcation and identification of coal-tar dyes, with an explanatory preface by F. Bordas.

A rapid volumetric method for determining alcohol, A. LACHMAN (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, p. 230*).—The method described, which is said to be exceedingly rapid and of a high degree of accuracy, is based upon the determination of the critical point of an equilibrium of the third order.

A fixed weight (25 gm.) of anilin is pipetted into a definite volume (50 cc.) of the alcohol-water mixture whose strength is to be determined. If the anilin does not dissolve, sufficient alcohol of known strength is added to clear the solution, after which water is added from a burette until the sharp end point of a permanent turbidity is reached. The percentage of alcohol in the sample is calculated from the known volume of the sample of added alcohol and of added water, the calculation depending upon the fact that the total volume of solvent (alcohol and water) is a nearly strictly linear function of the volume of contained alcohol. A condensed table is given of the total solvent volume and corresponding alcohol volume for 25 gm. anilin at 15.6° C. for amounts of

total solvent ranging from 50 to 146 cc. Corrections which must be applied are briefly enumerated. These include a temperature correction for other temperatures than a range of 14 to 17° and corrections for volume of water added and for contraction of volume of the sample.

Reactions of sugars and polyatomic alcohols in boric acid and borate solutions, with some analytical applications, G. VAN B. GILMOUR (*Analyst, 46 (1921), No. 538, pp. 3–10*).—The author discusses the reaction of boric acid solutions with polyatomic alcohols and sugars, and suggests as analytical applications the use of levulose or invert sugar for the volumetric estimation of boric acid, and of boric acid for the estimation of levulose.

The invert sugar reagent for the titration of boric acid is made by dissolving 25 gm. of cane sugar in 10 cc. of water and boiling for a few minutes, after which 1 cc. of N/2 HCl is added to the hot solution with thorough shaking. The solution is then diluted, cooled, and after the addition of 1 cc. of N/2 NaOH, made up to a volume of 50 cc. Of this solution 3 cc. is required to titrate 10 cc. of deci-molecular boric acid.

The method suggested for the estimation of levulose is to add to a weighed amount of the levulose mixture 10 cc. of a deci-molecular solution of boric acid and 0.5 cc. of a 1 per cent solution of phenolphthalein and titrate to the first distinct pink by the addition of N/10 NaOH. The levulose equivalent of the sodium hydroxid is read from a table of equivalents. Such a table, calculated for mixtures such as sirup and honey, is given.

Progress in beet sugar manufacture in 1920, E. O. VON LIPPMANN (*Chem. Ztg., 45 (1921), No. 23, pp. 181, 182*).—This is a summary of the agricultural, technical, chemical, and general phases of beet sugar investigation during 1920. No literature references are included.

Refining raw sugars without bone black, C. E. COATES (*Jour. Indus. and Engin. Chem., 13 (1921), No. 2, pp. 147–153*).—This is a general discussion of conditions to be met in the refining of raw sugars between seasons without the use of bone black as practiced to a considerable extent in Louisiana during the past few years. The author is of the opinion that with the present equipment of the Louisiana sugarhouses the best yields that can be expected are about 2.5 lbs. less sugar and 3.5 lbs. more molasses per 100 lbs. of raw sugar than obtained by the use of bone black.

It is thought that both the cane-sugarhouse and the beet-sugarhouse can be utilized profitably during the off season in refining raw sugars when there is a large enough margin between raw and refined sugars.

Vegetable decolorizing carbons.—Factors which govern their decolorizing effect, A. B. BRADLEY (*Internatl. Sugar Jour., 23 (1921), No. 265, pp. 25–32*).—This paper reports a continuation of the author's study of the factors governing the decolorizing effect of vegetable carbons (E. S. R., 43, p. 412). Comparative experiments were made with a number of decolorizing carbons, including several samples supplied by F. W. Zerban from among those examined in the investigation previously noted (E. S. R., 39, p. 113).

On treating a 50 per cent raw Jamaica sugar sirup with the various carbons in the proportion of 5 per cent of the weight of the sugar taken, the greatest decolorizing effect was produced with carbons giving the quickest rate of filtration. The activity of the carbon was independent of the percentage of carbon present but dependent upon the volume or bulk for a given weight, the more porous the carbon the greater being the decolorizing effect and more rapid the filtration. If used for treating successive batches of sugar sirup without revivification the carbons appeared to choke up first according to the amount of dust they contained and finally according to the percentage of large grains. Samples con-

taining the maximum quantity of medium grain gave the best results. Carbons containing high percentages of the finest grades gave better results when used on semirefined, washed, or good quality raw sugars than did larger sized carbons, while better results were obtained in treating raw sugars which were inclined to be gummy with a uniform medium grain carbon.

"Sugola," a new type of sirup, C. S. HUDSON (*Amer. Food Jour., 16 (1921), No. 4, pp. 11–13, figs. 3*).—A brief description is given of the Brown-Duryea process for making "sugola," a new type of maltose sirup of approximately the following composition: Maltose, 70 to 76 per cent; dextrose, 2 to 6; dextrin, 1 to 4; water, 20 to 22; ash, 0.3 to 0.4; and nitrogenous substances, 0.3 to 0.8 per cent. The sirup differs from other maltose sirups in containing only a small amount of dextrin and nitrogenous substances and in possessing a sweet taste without any malt flavor.

Fermentation process for the production of acetic and lactic acids from corncobs, E. B. FRED and W. H. PETERSON (*Jour. Indus. and Engin. Chem., 13 (1921), No. 3, pp. 211–213*).—The authors report from the Wisconsin Experiment Station that corncobs offer a promising raw material for the commercial production of acetic and lactic acid through fermentation of the xylose sirup with *Lactobacillus pentoaceticus* (E. S. R., 41, p. 614). The method as conducted experimentally consists in hydrolyzing the corncobs in an autoclave at 15 lbs. pressure for one to two hours with 2 per cent H_2SO_4. The concentrated sirup thus prepared, which contains from 20 to 30 per cent of xylose, is diluted to a xylose concentration of about 3 per cent, inoculated with pure cultures of the bacteria, and allowed to incubate for two weeks or more at 30° C. Analyses of the acids thus formed indicate that the fermentation is almost quantitative. The authors are of the opinion that the process offers a profitable means of utilizing corncobs.

The preparation and technical uses of furfural, K. P. MONROE (*Jour. Indus. and Engin. Chem., 13 (1921), No. 2, pp. 133–135*).—A method of obtaining furfural from corncob adhesive, prepared according to the method of LaForge and Hudson (E. S. R., 40, p. 17), is described as follows:

Five hundred gm. of the corncob adhesive is thoroughly mixed in a 3-liter round-bottom flask with a solution of H_2SO_4 prepared by mixing 150 cc. of the concentrated acid (sp. gr. 1.84) with 500 cc. of water. A lump of paraffin is added, the mixture heated to boiling, and a vigorous current of steam passed through, the rate of steaming and the flame being so adjusted that the volume of liquid in the flask remains approximately constant while the distillate is collected at the rate of 15 to 20 cc. per minute. Five 800 cc. portions of the distillate are collected, filtered to remove traces of paraffin, and fractionally distilled from a flask provided with a fractionating column. After fractionation the furfural phase in the combined distillates is separated from the supernatant saturated aqueous solution, which is then refractionated. The combined portions of the furfural phase are refractionated, the portion boiling between 161.5 and 162° C. consisting of furfuraldehyde of satisfactory purity. An average yield of 53 gm., or 26 per cent of the solid material of the adhesive, has been obtained by this technique. Suggested uses of furfural are in the dye industry and as a solvent and insecticide.

Indian casein.—I, Preparation of sulphuric casein, D. M. GANGOLLI and A. N. MELDRUM (*Bombay Dept. Indus. Bul. 1 (1920), pp. 11*).—This paper reports a study of methods of preparing high-grade casein by sulphuric acid precipitation. The best results were obtained when the separated milk was put through the separator several times to remove the fat more completely, the casein precipitated with N H_2SO_4, washed once with N/10 H_2SO_4, enough NaOH

added to bring the casein to its isoelectric point with a tendency to the alkaline side, and the casein finally washed with water. Throughout the precipitation and subsequent treatment the liquid was vigorously stirred by means of an electrically-operated rotating stirrer.

As the result of this study the authors agree with Browne (E. S. R., 42, p. 111) that the proportion of fat in casein depends upon the efficiency of the cream separation, but differ from him in regard to the factors governing ash content and the methods used for controlling it. While in the former investigation water alone was used in washing the curd, in the present study washing with acid and then with alkali was found to remove the inorganic matter effectively. A table is presented in which are included the data on the composition of various caseins reported by Browne, and data from the present study. The caseins prepared as outlined above had a lower content of fat, ash, and acid than the average of 34 samples of commercial casein prepared under special supervision, and lower ash and acid than the average of 5 samples of pure casein made by the Hammarsten and Van Slyke methods as reported by Browne.

Studies on bast fibers.—II, Cellulose in bast fibers, Y. Uyeda (*Jour. Indus. and Engin. Chem., 13 (1921), No. 2, pp. 141–143*).—This contribution from the California Experiment Station is a continuation of the studies on bast fibers previously noted (E. S. R., 43, p. 617). The effects of various preliminary treatments before chlorination on the yields of cellulose are reported, and the properties of the cellulose thus obtained are studied and discussed from the standpoint of cellulose and textile chemistry.

Chlorination without preliminary hydrolysis was found to give a higher yield and a product of more satisfactory quality than obtained by preliminary hydrolysis, a result in agreement with that obtained by Dore on the determination of cellulose in woods (E. S. R., 42, p. 614). A study of the chemical nature of the cellulose obtained from bast fibers indicates that it has a composition related to wood cellulose in having in some degree an oxycellulose structure.

Reading list on papermaking materials, compiled by C. J. West ([*Arthur D. Little, Inc.*], *Bibliog. Ser., No. 6 (1920–21), pp. 170*).—In this extensive bibliography the papermaking materials are listed under the common and botanical names, the references being given only under the latter. The list of materials is composed largely of vegetable fibers other than wood, only the less common varieties of wood used in papermaking being included. The bibliography is prefaced by an introductory section dealing with the classification, evaluation, and methods of study of papermaking materials and conditions in the United States.

METEOROLOGY.

On the rate of evaporation, J. Würschmidt (*Met. Ztschr., 38 (1921), No. 6, pp. 161–167, figs. 3*).—From the results of observations and experiments recorded in this article the author deduces the following formula for average evaporation: $V=C\left(r-\sqrt{\frac{hr}{2}}\right)$, in which r is the radius of the tank, h the height of the rim above the level of the water surface, and C a constant derived from the observed value of V, in these observations 220.10^{-4}.

Rainfall and barometric variation in Bulawayo, E. Goetz (*So. African Jour. Sci., 17 (1921), No. 2, pp. 155–157*).—The average rainfall of Bulawayo during 23 seasons is shown to be 23.4 in., apparently well distributed but actually with frequent prolonged droughts in the middle of the growing season in December or January.

Correlating the expansion of the barometric monthly means into a sine series with these droughts, the author finds "that the second harmonic seems to bear a very close relation with the variation of the rainfall, roughly between the middle of November and the middle of February."

He gives a table showing "the date of the maximum or minimum of the term $A_2 \sin (V_2 + 2x)$ and the rainfall around that date. The table is given for 22 seasons from July, 1897, to July, 1920. The season 1901–2 is omitted, as there was a break in the barometric observations. In 17 seasons the maximum falls in a period of drought or of serious shortage in the rains, and the minimum in a period of excessive rains. In 4 seasons there is a period of drought immediately preceding or following the maximum. In one season, 1918–19, the maximum falls in the middle of a period of good rains, preceded and followed by a notable shortage of the rains."

Great British droughts, C. HARDING (*Nature [London], 107 (1921), No. 2698, pp. 627, 628*).—The persistent dry weather of the present year in England is found to coincide with Brückner's 30 to 35-year period.

[Climate on the North Platte Reclamation Project, Scottsbluff, Nebr.], J. A. HOLDEN (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 3, 4, 5, 6*).—Observations on precipitation, evaporation, wind, temperature, and killing frosts, 1918–1919, as compared with the average, 1911–1919, are summarized in tables and briefly discussed.

"While the season of 1918 was one of the most favorable for crop production in the history of the project, that of 1919 was the most unfavorable. In 1919 the precipitation was far below normal, particularly during the early season. The rainfall during April for the past nine years has averaged 2.26 in., while in 1919 it was only 0.54 in. In 1919 the total rainfall for April, May, and June was only 3.03 in., while the 9-year average during this same period has been 6.66 in., or more than twice as much. The weather was not only dry but unusually hot, the evaporation being higher than during any previous season. The hot summer was followed by the coldest December during the period of record. The winter of 1918–19 was perhaps one of the most severe on live stock in the history of the project."

The frost-free period of 1918 was 129 days (May 9 to September 15); of 1919, 111 days (June 2 to September 21). "The maximum temperature in 1918 was 99° F. and the minimum —23°. In 1919 the maximum was 101° and the minimum —33°, which is the lowest temperature ever recorded at the experiment farm."

SOILS—FERTILIZERS.

Soil survey of Iowa.—Reports 13–18, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpts. 13 (1920), pp. 46, pl. 1, figs. 10; 14 (1920), pp. 60, pl. 1, figs. 12; 15 (1920), pp. 60, pl. 1, figs. 15; 16 (1920), pp. 54, pl. 1, figs. 12; 17 (1920), pp. 60, pls. 2, figs. 12; 18 (1921), pp. 56, pl. 1, figs. 10*).—These reports present analyses and greenhouse and field experiments to determine the composition, fertilizer requirements, and crop adaptations of the different soil types of the respective counties. The soils are grouped as drift, loess, terrace, swamp, and residual.

No. 13, Montgomery County.—This is an area of 271,360 acres in southwestern Iowa, lying entirely within the Missouri loess soil area. The upland of the county is in general a gently undulating plain cut by rather shallow valleys. The drainage is said to be in general quite satisfactory.

The loess soils cover 66.2 per cent of the area and swamp 27.9 per cent. Eight soil types of 6 series are mapped, of which the Marshall silt loam covers 66.1 per cent and the Wabash silt loam 27.1 per cent of the area.

The soils are usually slightly acid in reaction, requiring small applications of lime. The greatest need of the upland types is for organic matter. The phosphorus supply in the soils is not high, and the experiments indicate that the field use of phosphorus fertilizers may be profitable. Complete commercial fertilizers are not recommended for general use in the county.

No. 14, Black Hawk County.—This is an area of 361,600 acres in northeastern central Iowa, lying in the Iowan drift soil area. The topography is that of a gently rolling prairie, cut by river valleys. The natural drainage is said to be in general quite adequate.

Drift soils cover 44 per cent and loess 32.4 per cent of the area. Including meadow and muck, 31 soil types of 13 series are mapped, of which the Tama silt loam and the Carrington loam cover 31 and 28.7 per cent of the area, respectively.

A need for lime is indicated on practically all of the soils in the county. The organic matter content of many of the soils is low, and applications of farm manure have been found to be profitable on practically all of the soil types. The nitrogen content of many of the soils is neither low nor high, but must be added to regularly to maintain the supply. The phosphorus content is quite low in many cases, and even the better soils are not sufficiently supplied.

No. 15, Henry County.—This is an area of 273,280 acres in southeastern Iowa, lying entirely within the Mississippi loess soil area. There are two distinct topographic areas in the county. One is the gently undulating prairie, occurring in the northern and northeastern part, in which the natural drainage is poor; in the other, which constitutes the remainder of the county, the topography has been much modified by river action and is rolling to steeply rolling or hilly. Artificial drainage is not considered necessary in this area.

Loess soils cover 91.3 per cent of the area. Fifteen soil types of 11 series are mapped, of which the Grundy silt loam, Clinton silt loam, and Grundy silty clay loam cover 39.4, 26.9, and 14.9 per cent of the area, respectively.

The studies of individual soil types indicate that the soils of the county are in general somewhat acid in reaction, and many of them, especially the lighter types, are deficient in organic matter. The nitrogen content in most of the soils is not very low, but is constantly decreasing. The phosphorus content is not high in any case, and in several instances is quite low.

No. 16, Buena Vista County.—This is an area of 365,440 acres in northwest Iowa, lying entirely within the Wisconsin drift soil area. The upland of the county is in general a gently rolling plain. It is stated that artificial drainage is necessary over a considerable portion of the county.

Drift soils covers 94.2 per cent of the area. Including muck and peat, 13 soil types of 6 series are mapped, of which the Carrington loam, Carrington silt loam, and Webster silty clay loam cover 48.6, 27.8, and 15.7 per cent of the area, respectively.

Studies indicate that many of the soils are acid in reaction. The supply of organic matter is not low, and in some instances it is very high. However, even on the darker-colored types the application of small amounts of farm manure was found to be profitable. The phosphorus content is rather low. Complete commercial fertilizers are not now recommended for general use on soils of the county.

No. 17, Linn County.—This is an area of 453,760 acres in east-central Iowa lying partly within the Iowan drift soil area and partly within the Mississippi loess area. The topography is in general gently rolling with a slope toward the southeast. It is stated that some of the areas in the central drift plain are in need of artificial drainage.

Drift soils cover 69.6 and the loess 18.1 per cent of the area. Including muck, 28 soil types of 12 series are mapped, of which the Carrington silt loam and Carrington loam cover 49.7 and 10 per cent of the area, respectively.

The studies indicated that practically all of the soils of the county are acid, and that the organic matter content is low. The phosphorus content is also rather low, and it is thought that phosphate fertilizers will be needed in the near future.

No. 18, Wapello County.—This is an area of 273,920 acres in southeastern Iowa lying entirely within the Mississippi loess soil area. The upland of the county was originally a nearly level drift plain, but is now much eroded along the streams. The drainage system of the county is said to be quite complete.

Loess soils cover 81.9 per cent of the area. Including river wash, 23 soil types of 14 series are mapped of which the Clinton silt loam, Grundy silt loam, and Lindley loam cover 31, 30.1, and 15.6 per cent of the area, respectively.

One of the chief needs of the soils of the county is for organic matter. The soils are also practically all acid in reaction, and the phosphorus content is not high. The opinion is expressed that the use of phosphorus fertilizers will be needed in the near future if they do not prove of value at the present time. Complete commercial fertilizers are not recommended for general use in the county. The potassium supply in the soils is large.

The influence of water content and void space on the workability of soil, H. Zander (*Internatl. Mitt. Bodenk., 10 (1920), No. 3–4, pp. 89–117, figs. 9*).—Experiments with sand, loam, peat, and three different garden soils, to determine the influence of water content and physical condition of soil on the resistence to cultivation, are reported. The apparatus used is described, and the data obtained are analyzed mathematically.

It was found that when the soils studied contained only hygroscopic moisture they were the most easily worked. This condition was apparently independent of other physical characteristics.

The origin of strips (stränge) on peat moors, V. Auer (*Acta Forest. Fennica, 12 (1919–20), pp. VI+1–145, pls. 8, figs. 38*).—An extensive study is reported on the origin of the odd-colored strips of peat which are evident in many peat moors of Finland. These so-called "stränge" are parallel strips with approximately the same grade. It is concluded that they owe their origin mainly to the influence of the spring floods and ice movements in the moors of the region.

Acid soil studies.—I, II (*Soil Sci., 11 (1921), No. 5, pp. 353–367*).—Two studies conducted at the Oregon Experiment Station on the separates of four acid soils segregated by mechanical analysis are reported. The soils included silt loam, gravelly loam, clay loam, and medium sandy loam.

I. *A study of the basic exchange between soil separates and salt solutions,* by R. H. Robinson (pp. 353–362).—In studies of the action of N/10 solutions of the nitrate, chlorid, and acetate of potassium, calcium acetate, and sodium chlorid it was found that the acidities of the different soil separates liberated by the action of a certain salt solution were approximately the same. The manner in which the salts of mineral acids reacted with the soils studied appeared to differ from that of the salts of an organic acid. The so-called acidity liberated by potassium nitrate, potassium chlorid, and sodium chlorid is considered to be due mainly to aluminum and iron rendered soluble by basic exchange. The acidity produced by calcium and potassium acetates is considered to be due to acetic acid, liberated either by replacement of the hydrogen of hydrous silicates or by selective adsorption of the basic element in the salt solution. The hydrogen-ion concentration of different separates of the soil was constant.

II. *Changes in calcium compounds added to acid soils*, R. H. Robinson and D. E. Bullis (pp. 363–367).—In a second contribution to the subject, the soils were treated with chemically pure calcium carbonate and calcium oxid in amounts equivalent to the lime requirements of the soils.

It was found that the calcium retained in the soils after exposure to the weather for one year was combined chiefly with humus and easily decomposable silicates. Most of the calcium present in the acid soil that did not respond to lime treatment was found combined as difficultly decomposable silicate. The calcium added was combined chiefly as easily decomposable silicate. This is thought not to explain why the soil did not respond to lime treatment.

After exposure to the weather for one year all of the soils treated with either calcium carbonate or calcium oxid were alkaline according to the Veitch method.

The effect of organic nitrogenous compounds on the nitrate-forming organism, E. B. Fred and A. Davenport (*Soil Sci., 11 (1921), No. 5, pp. 389–407, figs. 4*).—In experiments conducted at the Wisconsin Experiment Station cultures of the nitrate-forming organism were isolated from different soil types and grown on washed nitrite agar and on slants of Nährstoff-Heyden agar with and without nitrite present. Nitrobacter grew on these media and retained its power of oxidizing nitrites to nitrates. Apparently under these conditions the presence of a small amount of Nährstoff-Heyden was beneficial to the growth of the nitrate former.

When inoculated into peptone-beef infusion or into Nährstoff-Heyden solution, the pure cultures of this organism failed to show any visible growth. It was not possible to determine conclusively whether growth took place in the tubes of liquid medium, however, as shown either by its turbidity or by microscopical examinations, and the conditions for growth in a deep layer of liquid medium compared with those on the surface of an agar slope where all the growth is concentrated in a small area, are deemed sufficiently different to bring about contradictory results. Beef infusion or peptone-beef infusion in the higher concentrations used proved toxic for the nitrate former, whereas the Nährstoff-Heyden in nearly all tests proved nontoxic.

From examinations of microscopical preparations made from liquid cultures in water, urine, peptone-beef infusion, and Nährstoff-Heyden solution, it was found that the bacteria do not reproduce in such media, except that perhaps in the Nährstoff-Heyden there is a slight multiplication of the organisms. The harmful substance found in beef infusion is present in only small amounts, since dilution of the beef infusion with an equal volume of water removed this poisonous property. The nature of this harmful substance is not known, except that it is nonvolatile as shown by steam distillation and is removed by extraction with ether or alcohol.

The nitrate former will live for two to six weeks and perhaps longer in 1 per cent solutions of Nährstoff-Heyden, gelatin, peptone, casein, and yeast water, and also in milk and distilled water, while in 1 per cent solutions of beef extract the bacteria are killed rapidly. The oxidation of nitrite in cultures to which small amounts of organic nitrogen were added took place rapidly; in the case of Nährstoff-Heyden more rapidly than in the water controls. Such compounds as gelatin, peptone, casein, skimmed milk, beef infusion, and beef extract showed no injury. Asparagin, ammonium sulphate, and urea retarded oxidation.

It is stated that from the results of these studies no evidence can be found to support the statements of Beijerinck that the nitrate-forming organism when grown in the presence of certain organic substances loses its power of oxidation Contrary to much of the literature, it was found that certain forms of organic matter benefit rather than injure these organisms. Growth of nitro-

bacter on nitrite agar slants was very scant as compared with that of the common heterotrophic bacteria, and appeared as tiny beads just visible to the naked eye. When inoculated into liquid nitrite medium this growth brought about oxidation in a shorter time than inocula from liquid cultures. Sealed nitrite agar slants were kept for more than a year without serious injury to their power of oxidation.

Sweet clover for nitrate production, A. L. WHITING and T. E. RICHMOND (*Illinois Sta. Bul. 233 (1921), pp. 255–267*).—Studies during the important periods of the season of the nitrate content of the surface soil of three series of fields, representative of the conditions in northern, central, and southern Illinois, on which sweet clover was used as a green manure, where stable manure was applied, and where there was no treatment are reported.

The soil of the first two fields is a brown silt loam and of the last three a gray silt loam on tight clay. It was found that on both soils sweet clover when plowed under as a green manure for corn furnished large amounts of nitrate nitrogen for that crop. The large nitrogen content of sweet clover is taken to indicate that a large fixation of nitrogen occurs on these soils. In the present study the sweet clover tops averaged 87.6 lbs. of nitrogen per ton of dry matter at sampling time, which, in some cases, was about the time of plowing for corn, while in others it was somewhat earlier.

The data reported are concluded to furnish positive information concerning the value of sweet clover when used as a green manure for solving the problem of adding to, conserving, and making the nitrogen of the soil available for crop purposes.

Experiments on manuring of green crops, H. R. COOPER (*Indian Tea Assoc., Sci. Dept. Quart. Jour., No. 4 (1920), pp. 144–151*).—The results of three years' studies on the manuring of green crops on acid soils of Borbhetta are summarized.

It is concluded that the addition of lime in small amounts gives a marked and permanent increase in fertility, although there may be a temporary reduction in fertility immediately after application. Very small applications of phosphoric acid produced marked increases in the fertility of newly broken soil. Even very heavy applications produced no bad results, but on the other hand increased crop yields. The residual effect of small applications was distinct though small, while that of large applications was proportionately greater. It is concluded, however, that the smaller applications are more economical.

Potash salts appeared to have a negligible good effect in small amounts immediately after application and showed a marked toxic effect when used in large amounts, but even the large amounts produced marked increases in fertility after a lapse of time.

Paddy manurial experiments, J. SEN (*Agr. Research Inst. Pusa Sci. Rpts., 1919–20, pp. 43, 44*).—A series of experiments with local paddy to compare the effect of ammonium sulphate used alone and in combination with green manures showed that, so long as phosphate manures were simultaneously applied, an increasing application of nitrogen gave increased yields up to a certain point beyond which there was a decrease. When double the critical amount of nitrogen was applied the yields were little better than with no nitrogen. Small amounts of nitrogen tended to increase the proportion of straw to grain.

Green manure used alone gave a total crop increase of 65 per cent, but when in conjunction with ammonium sulphate had no appreciable effect. The use of ammonium sulphate resulted in an increase in the percentage of nitrogen found in the grain approximately proportional to the amount of nitrogen added.

Experiments with fertilizers for cane, F. A. López Domínguez (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 20–31*).—Two series of experiments on the use of fertilizers for cane soils are reported.

Experiments on the fertilizer requirements of relatively unproductive clay soils showed that lime is necessary for the growing of cane. Nitrogen is the limiting fertility element, and about the same results were obtained with potash as with phosphoric acid. In the presence of an excess of nitrogen, however, better results were obtained with phosphoric acid than with potash. In general, a complete fertilizer produced better results on these soils than one containing two elements, although the economic advantage of a complete fertilizer was found to depend upon the price of the fertilizer and of the cane. When using only two fertilizer ingredients it is considered preferable to use nitrogen and phosphoric acid. Fertilizers of mineral origin were found to be preferable on cane in these soils.

In experiments on hilly clay soils growing cane it was found that the use of fertilizers was profitable, and that in general complete fertilizers containing a large proportion of nitrogen and phosphoric acid gave better results than incomplete fertilizers. Phosphoric acid was found to be the limiting fertility ingredient, followed by nitrogen. Where fertilizers are applied these soils require frequent fallowing. Potash is not considered to be absolutely necessary.

Thirty years of field experiments with crop rotation, manure, and fertilizers, M. F. Miller and R. R. Hudelson (*Missouri Sta. Bul. 182 (1921), pp. 43, figs. 11*).—From these field experiments, begun in 1888, it was found that in general crop rotations gave better yields than were secured from crops grown continuously without rotation. Among the rotations used, the 4-year rotation of corn, oats, wheat, and clover gave somewhat better results than the others. Crop rotation without manure was practically as effective in maintaining the average yields of corn and wheat as was heavy manuring where these crops were grown continuously without rotation.

Manure was more effective in maintaining a high average yield of corn and grass in a 6-year rotation than was heavy fertilization with chemical fertilizers, but the reverse was true in the case of wheat and oats. When measured by the 30-year average yield, heavy applications of chemical fertilizers were as effective as heavy applications of barnyard manure in maintaining the total produce in a 6-year rotation of corn, oats, wheat, clover, timothy, and timothy, but when averaged by successive 5-year periods, the results indicate a growing superiority of manure or a combination of manure and fertilizer.

Soil analyses at the end of 25 years indicated that the most important factor in soil exhaustion was the loss of nitrogen and organic matter. The crops grown continuously without rotation or manure stood in the following general order with reference to the reduction of the supply of nitrogen: Corn, oats and wheat, and hay crops. Heavy applications of barnyard manure were very effective, and heavy applications of chemical fertilizers were ineffective in maintaining the supply of soil nitrogen. Crop rotation was more effective on the average than continuous cropping to grain crops, but less effective than continuous cropping to grass, in maintaining soil nitrogen.

Experiments on radioactive fertilizer, P. Andouard (*Jour. Agr. Prat., n. ser., 34 (1920), Nos. 50, pp. 470, 471; 51, pp. 491, 492*).—Field experiments with clover on four experimental plats to determine the fertilizing action of a so-called radioactive fertilizer containing 0.05 per cent of uranium oxid and showing a certain amount of radioactivity are reported.

It was found that both positive and negative results were obtained with this fertilizer. In some cases there were noteworthy increases and in other cases considerable decreases. Since the other treatments of the plats were identical no conclusions are drawn, but the experiments are to be continued.

The use of guanol for the cultivation of moor soils, A. GEHRING (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 38 (1920), No. 24, pp. 373–376*).—A brief review of the manufacture of guanol is given, and the results of a number of experiments with guanol or moor soils are reported. Attention is drawn in this connection to the relatively low bacterial content of moor soils and the relatively high bacterial content of damp guanol.

Experiments with oats on moor soils showed that the first year the best results were obtained with the smaller applications of guanol, but that the second year the more heavily treated plats yielded much larger crops, indicating a marked residual action. Further experiments with oats and potatoes gave somewhat similar results the first year, but showed that from 500 to 1,000 kg. (1,100 to 2,200 lbs.) per acre of guanol produced larger crops of oats on moor soil the first year than 20,000 kg. of stable manure.

The nitrogen question, P. PASCAL (*Rev. Sci. [Paris], 58 (1920), No. 24, pp. 740–746*).—A discussion is given of the nitrogen situation of the world, but more particularly of Europe. Special attention is drawn to the utilization of air nitrogen, and a comparative study of the electric arc, cyanamid, and Haber processes indicates that the Haber process is much the cheapest.

Data are also given on the world's capacity for nitrogen production in 1913 and 1920. In 1920 the countries of central Europe led the world in the production of cyanamid, synthetic nitrogen by the Haber process, and ammonium sulphate, while the Scandinavian countries were second in synthetic products, France third, and the United States fourth. The synthetic products produced by the United States were limited to cyanamid. England was second in the production of ammonium sulphate.

The nitrogen problem, J. A. WILKINSON (*So. African Jour. Sci., 17 (1920), No. 1, pp. 95–110*).—Different processes of nitrogen fixation are described, including the Birkeland-Eyde, Schönherr, Pauling, Moscicki, Haber, and cyanamid processes, and data on costs of production of the different processes are presented.

Synthetic nitrogenous fertilizers, E. J. RUSSELL (*Jour. Min. Agr. [London], 27 (1921), No. 11, pp. 1037–1045*).—The author summarizes available data on synthetic fertilizers, including calcium nitrate, ammonium nitrate, ammonium carbonate, ammonium chlorid, urea, and cyanamid. It is pointed out that calcium nitrate and sodium nitrate are equally as effective per unit of nitrogen. Ammonium nitrate has been found to be quick in action and somewhat better than sodium nitrate in some cases. It is much more concentrated than ammonium sulphate or sodium nitrate, and contains as a rule about 34.8 per cent of nitrogen of which one-half is in the form of ammonium and one-half nitrate nitrogen. The broad result of all the trials of cyanamid indicate that it is somewhat slower in action than ammonium sulphate and about 90 per cent as effective as sodium nitrate.

Nitrogen experiments, W. SCHNEIDEWIND, D. MEYER, and F. MÜNTER (*Landw. Jahrb., 55 (1920), No. 1, pp. 1–20*).—In comparative tests of sodium nitrate, Norwegian calcium nitrate, and calcium nitrite with oats on sand and loess loam soils and with beets on a mixture of sand and loess loam, the Norwegian nitrate and the calcium nitrite increased the oats crop more than sodium nitrate, although the differences were within the limits of experimental error. Norwegian nitrate gave as good results with beets as sodium nitrate. The great-

est nitrogen recovery was obtained with sodium nitrate, followed in order by Norwegian nitrate and calcium nitrite.

Sodium nitrate, Norwegian nitrate, Schlösing nitrate, and urine were compared for oats on sand and loess loam soils. The greatest increased yields were obtained with the Norwegian and Schlösing nitrates, although the nitrogen recoveries were about the same with all the fertilizers. Mixtures of one-half urine and one-half earth and two-thirds urine and one-third earth gave about as good yields as sodium nitrate. Mixtures of three-fourths urine and one-fourth earth resulted in marked nitrogen losses. These losses were greater when the urine was applied as a surface fertilizer, and the yields were much less.

Comparative tests of sodium nitrate, ammonium sulphate, and lime nitrogen on different soils when applied in the fall and in the spring showed that on pot cultures there was little difference between the results of fall and spring use of sodium nitrate. In plat experiments, however, the results of fall use of sodium nitrate were negligible since most of the nitrate was leached out. Similar results were obtained with ammonium sulphate. Lime nitrogen was not leached out from the soil like the other fertilizers, about 25 per cent remaining from fall applications.

When sodium nitrate, ammonium sulphate, ammonium nitrate, and urea were compared on a mixture of equal amounts of loess loam and sand growing potatoes and beets, practically equally increased yields of potatoes were obtained from the use of the first three fertilizers, while the increases from urea were smaller. Sodium nitrate gave the best results with beets.

Comparative tests of the losses of sodium nitrate, ammonium sulphate, ammonium nitrate, urea, urea nitrate, guanidin nitrate, and liquid manure when applied as top-dressings to oats on sand soil, humus, loess loam soil, and a mixture rich in lime of loess loam soil and subsoil showed that on the sand and loess loam soils the greatest yields and nitrogen recoveries were obtained with sodium nitrate and the smallest with liquid manure. About the same results were obtained with surface application as when the fertilizers were mixed with the soil, although nitrogen recoveries were smaller in some cases. On the soil mixture rich in lime as good results were obtained with surface applications of sodium nitrate, urea, urea nitrate, and guanidin nitrate as when these fertilizers were mixed with the soil. Surface application of ammonium sulphate and ammonium nitrate did not give as good results as when mixed with the soil. Practically all the nitrogen of surface applications of ammonium sulphate to the soils rich in lime was lost.

The addition of small quantities of bog ore and lead nitrate to sodium nitrate, and of bog ore to lime nitrogen, when applied to oats did not increase the fertilizing action of either fertilizer and decreased the action of lime nitrogen. A final comparatve experiment showed that molasses sludge was 64 per cent as effective for oats as sodium nitrate.

Field experiments with cyanamid, E. Clerfeyt (*Ann. Gembloux, 27 (1921), No. 4, pp. 132–140*).—In experiments on sandy soil with pervious subsoil and on sandy loam soil with oats, fodder beets, and potatoes, it was found that cyanamid gave good results on all crops when used in the presence of sufficient phosphoric acid and potash. It was more active in sandy clay and sandy clay loam soils than in dry sand soil. While both powdered and granulated cyanamid gave increases, the results were always somewhat in favor of the powdered cyanamid.

Urea and some other sources of nitrogen for green plants, T. Bokorny (*Pflüger's Arch. Physiol., 172 (1918), pp. 466–496*).—Experiments are reported which showed that urea may serve as a source of both carbon and nitrogen for

green plants. Hippuric acid is not as good a nutrient, since when it decomposes benzoic acid is freed, which apparently causes injury.

Human urine was found to be a better plant nutrient than animal urine, since most of the nitrogen content of the former is in the form of urea.

The addition of from 0.5 to 1 per cent of sulphuric acid to urine was found to retard decomposition and the consequent loss of nitrogen by transformation of the urea into ammonium carbonate. The addition of gypsum to urine was found to prevent ammonia losses when the urine was applied to cultivated soil.

The urea molecule is said to contain almost three times as much nitrogen as sodium nitrate, and is considered an equally active nitrogenous fertilizer.

Phosphoric acid experiments, W. SCHNEIDEWIND, D. MEYER, and F. MÜNTER (*Landw. Jahrb., 55 (1920), No. 1, pp. 21–39*).—Experiments on the action of the phosphoric acid in 19 different Thomas meals containing from 9.48 to 22.64 per cent of total phosphoric acid and from 8.35 to 16.28 per cent of citrate-soluble phosphoric acid are reported. These included a 2-year experiment with rye grass and a 3-year experiment with mustard and oats on a mixture of 90 per cent sand and 10 per cent loess loam. It was found that the activity of the phosphoric acid of Thomas meal had no direct relation either to the content of fine meal or to the alkalinity. The results indicated on the other hand that the activity corresponds to the citrate solubility of the phosphoric acid, which varies with different Thomas meals.

Five years' study on the action of the phosphoric acid of superphosphate and Thomas meal when the total amount for the period was applied at one time and when it was distributed throughout the period in annual applications with and without liming are also reported. The crops were oats and horse beans, and the soils were red loam, loess loam, and red sand.

Liming did not increase the yields on the loess loam soil which was rich in lime, but increased the yields on the other two soils. Phosphoric acid additions increased yields on the loam and loess loam soils deficient in phosphoric acid, but not on the sand soil. The phosphoric acid of the sand soil was more available to crops than that of the more fertile and heavier soils.

About the same results were obtained with superphosphate as with Thomas meal on all three soils when limed. The marked action of Thomas meal on the unlimed sand soil deficient in lime is attributed to its lime content rather than to its phosphoric acid content.

For both forms of phosphoric acid, total fertilization for the period at the beginning had a marked residual effect on all three soils. Such fertilization with Thomas meal gave somewhat better general results than annual fertilization. With total fertilization with superphosphate an excess assimilation of phosphoric acid by the crops apparently occurred the first year, resulting in a decrease in crops in the following years.

On limed soils the assimilation of the phosphoric acid of superphosphate was greater than that of Thomas meal. The reverse was true on the unlimed soils. The utilization of phosphoric acid was as great and in some cases greater with total fertilization at the beginning as with annual fertilization.

Solubility of basic slags, J. E. STEAD, F. BAINBRIDGE, and E. W. JACKSON (*Faraday Soc. Trans., 16 (1921), No. 2, pp. 302–309, figs. 1*).—Part 1 of this paper reports studies to determine why fluorspar in basic slags reduces solubility. The second part reports studies on the solubility of basic slags in citric acid and water solutions of carbon dioxid.

It is concluded that fluorspar makes the phosphoric acid in basic slag relatively insoluble because the fluorid unites with the calcium phosphate and produces artificial apatite, which resembles fluorapatite as regards insolu-

bility. Calcium chlorid was found to have the same effect as fluorspar. The most soluble slags were made insoluble on melting them with fluorspar.

It was proved that the finer the powder the more phosphoric acid is dissolved from all insoluble slags by citric acid, and that with the same material long-continued attack by carbonic acid generally dissolves out more phosphoric acid than a single attack by the standard citric acid method. It was also found that as a rule the more insoluble a slag the less readily is the phosphoric acid dissolved out of it by either solvent.

A comparison of the effect of various types of open hearth basic slags on grassland, G. S. Robertson (*Faraday Soc. Trans., 16 (1921), No. 2, pp. 291–301, figs. 6*).—A number of field experiments are reported, which indicate that open hearth basic slags provide a valuable source of phosphoric acid for soils very deficient in this ingredient, and that these slags can be very profitably used for the improvement of heavy clay soil pastures and meadows. Both laboratory and field experiments indicate that open hearth basic slag is not a uniform material, and that important differences may exist between two slags of similar solubility. Citric acid solubility was found to be neither a criterion nor an approximate indication of the fertilizing value of open hearth basic slags as compared with high citric-acid-soluble basic slags. It is pointed out that open hearth basic slags contain a new type of phosphate, and the advisability of conducting experiments on both arable and grass lands with as many different types of these slags as can be procured is emphasized.

Potash experiments, W. Schneidewind, D. Meyer, and F. Münter (*Landw. Jahrb., 55 (1920), No. 1, pp. 40–45*).—Comparative experiments with potassium chlorid and sulphate, phonolite, volcanic phonolite, and leucite on potatoes and beets showed that the phonolites and leucite had relatively little fertilizing action.

Further experiments with the same crops showed that potassium sulphate, potassium magnesium sulphate, and molasses sludge gave better results than 40 per cent potash salt.

Sodium chlorid applied to beets at the time of planting and as a top-dressing in July gave noteworthy increases in yield. When applied as a top-dressing late in August, the increase in yield was much smaller.

Comparative experiments on the action of sodium chlorid and sulphate and magnesium chlorid and sulphate on oats in sand loam and loess loam soils, when added in amounts of 0.125 and 0.25 per cent with and without lime, showed that the chlorids, especially in the larger applications, retarded plant growth the most, while magnesium sulphate retarded growth the least. The sulphates generally did not injure the crops, and in some cases apparently slightly increased the grain yield. The chlorids in the smaller applications did not injure the crop yield, and apparently increased the grain yield on the loam soils. On the sand soils the chlorids were specially injurious in the larger applications. Magnesium chlorid was generally more injurious than sodium chlorid. The addition of lime with the chlorids seemed to increase their injurious action.

Fertilizer experiments with potash salts with and without magnesia content, O. Nolte (*Mitt. Deut. Landw. Gesell., 36 (1921), No. 8, p. 136*).—Experiments with potatoes on a weak humus diluvial sand soil with siliceous subsoil, to compare the fertilizing action of potash salts containing magnesia with those not containing magnesia, are reported. The results showed that treatments with potassium magnesium sulphate and potassium chlorid decreased the yield and starch content, but that treatment with potassium chlorid and kieserite increased the yield although the starch content was decreased.

Natural finely divided (colloidal to coarsely disperse) chalk lime and its importance for forestry and agriculture, L. TSCHERMAK (*Centbl. Gesam. Forstw., 45 (1919), No. 11–12, pp. 245–283, figs. 7*).—Studies on so-called colloidal chalk, which occurs in the province of Volhynia in Russia, are reported.

This material is a loose, earthy, plastic material containing from 86 to 96 per cent calcium carbonate. It is found under glacial, loessial, and alluvial formations. It shows distinctly colloidal properties, such as shrinking and swelling, is plastic when damp, sticky when wet, and flows when saturated. The particles are mostly of a size less than 0.002 mm., and after complete drying and hardening the material again becomes plastic when moistened and swells. As distinguished from ordinary chalk lime, colloidal chalk is not stratified and contains inclusions of flint and chalk and scales of granite and sandstone.

Colloidal chalk is said to be much more active in soil formation than ordinary chalk lime, and where it occurs the soils show crumb formation and are well rooted.

Report of the fertilizer and cottonseed meal inspections and analyses, season of 1919–20 (*Little Rock, Ark.: Bur. Mines, Manfr., and Agr., [1921], pp. 56*).—This bulletin contains the results of actual and guarantied analyses and valuations of 572 samples of fertilizers and fertilizer materials collected for inspection in Arkansas from October 1, 1919, to September 30, 1920, together with a list of agencies receiving fertilizer shipments in 1920.

Commercial fertilizers, S. H. WILSON ET AL. (*Ga. Dept. Agr., Quart. Bul. 84 (1920), pp. 138*).—This bulletin contains the text of the Georgia fertilizer inspection law and the results of actual and guarantied analyses and valuations of 3,162 samples of fertilizers and fertilizer materials collected for inspection in the State from August 10, 1919, to October 1, 1920.

Commercial fertilizers, E. G. PROULX ET AL. (*Indiana Sta. Bul. 253 (1921), pp. 3–71, fig. 1*).—This bulletin reports the results of actual and guarantied analyses of 1,491 samples of fertilizers and fertilizer materials collected for inspection in Indiana during 1920. Of this number, 944 samples were found to be equal to the guaranty in every particular and 1,267 equal in value to the guaranty. Of 966 samples of fertilizer containing nitrogen analyzed 263 contained inferior nitrogen. A pot test of muck nitrogen is also briefly noted, showing that it was only one-tenth as available as sodium nitrate nitrogen.

Report of analyses of commercial fertilizers (*La. Dept. Agr. and Immigr. Fert. Rpt. 1918–19, pp. 62*).—This bulletin contains the results of actual and guarantied analyses made at the Louisiana Experiment Stations of 2,392 samples of fertilizers and fertilizer materials collected for inspection in Louisiana during the year 1918–19.

Inspection of commercial fertilizers for the season of 1920, H. D. HASKINS, L. S. WALKER, ET AL. (*Massachusetts Sta. Control Ser. Bul. 14 (1920), pp. 3–92*).—This bulletin contains the results of actual and guarantied analyses and commercial valuations of 1,311 samples of fertilizers and fertilizer materials, representing 492 brands collected for inspection in Massachusetts during 1920. In addition, a list of manufacturers is given, together with considerable general information of an explanatory character regarding the manufacture, mixing, composition, quality, purchase, valuation, and use of fertilizers.

I, Analyses of fertilizers, season 1919–20. II, Analyses of cottonseed meal, W. G. HAYWOOD ET AL. (*N. C. Dept. Agr. Bul., 41 (1920), No. 16, pp. 49*).—This bulletin contains the results of actual and guarantied analyses and valuations of 1,046 samples of fertilizers and fertilizer materials and 131 samples of cottonseed meal collected for inspection in North Carolina during the fall months of 1919 and the spring months of 1920.

Fertilizer report (*Penn. Dept. Agr. Bul. 347 (1920), pp. 79*).—This bulletin gives the substance of the Pennsylvania fertilizer inspection law and reports the results of actual and guarantied analyses of 827 samples of fertilizers and fertilizer materials, representing 503 different brands collected for inspection in the State from August 1 to December 31, 1919. These included 360 complete fertilizers, 252 nitrogen and phosphoric acid fertilizers, 23 ground bone fertilizers, 86 acidulated phosphate fertilizers, 98 rock and potash fertilizers, and 8 miscellaneous fertilizers.

The results of chemical analyses of these samples show that of the total number 25.4 per cent were deficient in one or more elements of plant food. The largest number of deficiencies occurred in the case of ground bone, complete, and rock and potash fertilizers. The most noticeable feature of the composition of these fertilizers was an increase in the amount of potash furnished by the complete and rock and potash fertilizers.

Fertilizer report, J. W. Kellogg (*Penn. Dept. Agr. Bul. 352 (1921), pp. 93*).—This bulletin presents the text of the Pennsylvania fertilizer inspection law and reports and discusses the results of actual and guarantied analyses of 1,078 samples of fertilizers and fertilizer materials, representing 676 brands, collected for inspection in Pennsylvania from January 1 to July 31, 1920.

The results of chemical analyses showed 29.9 per cent of the samples deficient in one or more of their guaranties for nitrogen, phosphoric acid, and potash. The largest proportion of deficiencies occurred in the complete fertilizers, where 34.3 per cent were deficient. In the nitrogen and phosphoric acid class 30.1 per cent were deficient, and in the ground bones 22.6 per cent.

Tabulated analyses of commercial fertilizers from samples collected in accordance with Tennessee fertilizer law, enacted April 9, 1903, F. M. McRee and J. W. Sample (*Tenn. Dept. Agr. [Fert. Bul.], 1920, pp. 53*).—This bulletin contains the text of the Tennessee fertilizer inspection law, rules and regulations for the sale of fertilizers, and the results of actual and guarantied analyses and valuations of 372 fertilizers and fertilizer materials collected for inspection in the State during the year 1920.

AGRICULTURAL BOTANY.

Plant breeding work at Aberystwyth, R. G. Stapledon (*Jour. Min. Agr. [London], 27 (1920), Nos. 7, pp. 630–639, pls. 7; 8, pp. 739–748, pls. 2*).—This report gives a description of the plant breeding station established at Aberystwyth for the purpose of improving and breeding strains of agricultural plants suitable for Welsh conditions, and an account of the investigations conducted preliminary to the actual breeding work. Two methods are now being employed, one involving the planting of seed and the other of whole plants. The tests have involved work with cocksfoot, tall oat grass, crested dog's-tail, meadow foxtail, timothy, perennial rye grass, tall fescue, and rough-stalked meadow grass, but up to the present more fully with cocksfoot than with any other grass. The results are given in tabular form with discussion. The indigenous plants were superior as regards lateness. An important aspect of the work has been the critical study of varieties.

The potato and closely related plants have been attacked by both smut and rust to a greater extent than any other group of allied varieties.

Heritable characters of maize, IV–VI (*Jour. Heredity, 11 (1920), Nos. 4, pp. 160–167, figs. 7; 7, pp. 317–322, figs. 4; 8, pp. 349–357, figs. 9*).—This continues the series begun by Collins and Kempton (E. S. R., 44, p. 25).

IV. *A lethal factor—defective seeds*, D. F. Jones.—The author outlines a study of defective maize seeds showing the presence of a lethal factor, the results of which in inheritance are herein made apparent.

The character, defective seeds, is considered as a useful one in studies of linkage relations in corn, as it is a seed character and easily classified in most cases. It presents an illustration of defective germ plasm, which is widely distributed in a cross-fertilized organism and has vital importance in life processes.

V. *Adherence*, J. H. Kempton.—Forms of adherence as studied, though generally difficult to propagate, gave small quantities of seeds with which to continue the investigation of this behavior, which is thought to be related to a Mendelian character recessive to the normal condition.

VI. *Zigzag culms*, W. H. Eyster.—Zigzag culm, which may appear about tasseling time in the development of a corn plant, though an inherited character, is probably not an example of mutation. Data obtained in the study here described are considered to indicate that zigzag culm comes into expression only when at least two factors are recessive, and that this is probably another case of plural genes. Crucial tests of the hypothesis are yet to be made.

Chlorophyll factors of maize, E. W. Lindstrom (*Jour. Heredity, 11 (1920), No. 6, pp. 269–277, figs. 3*).—Certain striking chlorophyll abnormalities are shown by breeding evidence to be distributed in several different chromosomes of maize. From this it is inferred that other less pronounced deficiencies of chlorophyll are distributed in a similar manner. Such distribution might by elimination tend to remove some of the more favorable factors. It is considered likely that continuous inbreeding may remove favorable as well as unfavorable factors from the original stock.

To succeed in a system of maize inbreeding it is therefore essential to begin with the best source of material available, one that is as free as possible from defects and abnormalities.

Selective fertilization in pollen mixtures, D. F. Jones (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 38 (1920), No. 5, pp. 251–289*).—Results outlined as obtained from maize seem to stand alone in showing a selective action unfavorable to fertilization by sperm from individuals of different hereditary constitution. The significance of this and other facts is discussed.

Studies in heredity and selection in Vicia.—I, Eye color in V. faba, M. J. Sirks (*Genetica*) [*The Hague*], *2 (1920), No. 3, pp. 193–199*).—In *V. faba* black eye as opposed to white eye appeared in the ratio of 3:1. Nonconformity was noted in free-blooming plants.

Female sterility in timothy grass and its inheritability, H. Witte (*Svensk Bot. Tidskr., 13 (1919), No. 1, pp. 32–42, figs. 2*).—Female sterility in *Phleum pratense* proved to be recessive. Crossing between hermaphrodite and male flowers resulted in a simple monohybrid splitting.

The tree dahlia of Guatemala, W. Popenoe (*Jour. Heredity, 11 (1920), No. 6, pp. 264–268, figs. 3*).—Regarding *Dahlia maxonii*, described by Safford (E. S. R., 42, p. 641), the author believes that the double-flowered varieties have their origin in the single-flowered typical form. The species seems to lose its stability in cultivation. A brief account is given of the varieties observed, one of which, at least, is believed to originate as a bud sport.

The origination of xerophytism, D. T. MacDougal and H. A. Spoehr (*Plant World, 21 (1918), No. 10, pp. 245–249*).—The conclusions reached in this and related papers are to the effect that succulence results from the conversion of polysaccharids into pentosans or mucilages, and that xerophytism results from a conversion of the polysaccharids into the anhydrids or wall material,

both these transformations being induced by a depleted or lessened water supply in the cells.

Absorption of moisture by gelatin in a saturated atmosphere, C. A. and S. P. Shull (*Amer. Jour. Bot., 7 (1920), No. 8, pp. 318–326, fig. 1*).—Experimentation described herein, as carried on with gelatin in saturated atmosphere under very carefully controlled conditions, suggests the desirability of a reinvestigation of the relation of vapor pressure of colloids to the vapor pressure of water.

The effects of irradiation by mesothorium and polonium on the growth of luminous bacteria, C. M. Voormolen (*Rec. Trav. Bot. Néerland., 15 (1918), No. 3, pp. 229–234, figs. 2*).—In studies not yet completed, it has been found that the development of certain luminous bacteria is hindered or prevented in those portions of Petri dish cultures which are subjected to irradiation with mesothorium or polonium.

The significance, for the host, of the bacteria in root nodules of the Papilionaceae, M. W. Beijerinck (*K. Akad. Wetensch. Amsterdam, Verslag Wis en Natuurk. Afd., 26 (1918), pt. 2, pp. 1456–1465*).—It is claimed that in case of many groups of the Papilionaceae which flourish when supplied with abundance of nitrogen, and also in case of cultures growing in media containing no nitrogen compounds, the number and volume of nodules are very small. The binding of free nitrogen by the plant itself should, therefore, be inferred on account of the vigor of nitrogen fixation in many such cases.

Plant indicators: The relation of plant communities to process and practice, F. E. Clements (*Carnegie Inst. Wash. Pub. 290 (1920), pp. XVI+388, pls. 92, figs. 25*).—This volume is intended as a companion volume to Plant Succession (E. S. R., 37, p. 434). Its main theme is succession as the primary basis for a system of indicator plants. The general principles and specific indicators have been tested repeatedly during the field work of the past five years, a special inquiry having been made during the season of 1918 into indicator relations throughout the West. The several sections deal with the concept and history of indicators, bases, and criteria, the kinds of indicators, climax formations of western North America, agricultural indicators, grazing indicators, and forest indicators. An extensive bibliography is given.

A quantitative analysis of plant growth, I, II, G. E. Briggs, F. Kidd, and C. West (*Ann. Appl. Biol., 7 (1920), Nos. 1, pp. 103–123, figs. 9; 2–3, pp. 202–223, figs. 6*).—These are the first two of a series of articles which constitute an attempt to formulate methods for the quantitative analysis of plant growth and to apply these methods.

In the first part the relative growth-rate curve and the leaf area ratio curve have been employed in the study of maize. The first noteworthy result of this analysis is to show that the growth rate varies greatly at different periods in the life cycle of maize in a definite manner. The fact that the curve for leaf area per unit dry weight throughout the season corresponds with the growth-rate curve indicates that the physiological basis for increased and decreased relative rate of growth is a corresponding change in the assimilating area per unit dry weight. Evidence from the quantitative analysis of plant growth for maize indicates that the seedling leaves do not perform their normal assimilatory functions until some time after their appearance.

Continuation of these analytical studies as recorded in the second chapter gives evidence that the unit leaf rate is correlated more closely with temperature than with any of the other environmental factors. Values for real assimilation show a closer correlation with temperature than with light. Values for assimilation determined from the unit leaf rate are of a lower order than those

determined by the half-leaf method but much higher than those determined by the gasometric method.

Biological factors influencing crop yields, V. RIVERA (*Riv. Biol., 2 (1920), No. 2, pp. 153–172, pl. 1*).—It is concluded that as between the factors intensity and duration of illumination, the latter is more important. Excessive luminous intensity does not favor the development of most plants. High temperature tends to shorten the vegetative period. Productivity is closely connected with elevated temperature and length of exposure to light. Regional differences are discussed.

The effects of light on plants, F. SCHANZ (*Biol. Zentbl., 38 (1918), No. 7, pp. 283–296, figs. 5; trans. in Sci. Amer. Mo., 1 (1920), No. 1, pp. 12–16*).—Phenomena described with discussion are mainly generalized in the statement that in the higher mountain regions a low form of vegetation showing particularly vigorous growth appears to be conditioned by the large quantities of rays of short wave length which act upon the plants in such regions. At lower levels this stimulus diminishes, and plants increase in the length of their growth in direct proportion to this diminution. Other influences, as temperature, humidity, and air currents are admittedly operative, but light is considered to surpass all others in importance.

[Temperature and seed germinability], O. MUNERATI (*Atti R. Accad. Naz. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29 (1920), II, No. 7–8, pp. 273–275*).—This is a partial report, to be followed by a more complete account, of studies with cereals, which indicates that keeping fresh seed grains at low temperatures (12 to 15° C. or 53.6 to 59° F.) tends to preserve germinability.

The relation between temperature and growth in the roots of Lepidium sativum, E. G. C. TALMA (*Rec. Trav. Bot. Néerland., 15 (1918), No. 4, pp. 366–422, figs. 6*).—It was found that the growing zone of the root of *L. sativum* is from 3 to 4 mm., its length not varying with temperatures. As with other physiological processes, the optimum changes its position with the observation time. The minimum appears to lie below 0° C., the maximum about 40° C. (104° F.), or lower for experiments of longer duration.

A new high-temperature record for growth, D. T. MACDOUGAL (*Science, n. ser., 53 (1921), No. 1372, pp. 370–372*).—In a previous publication (E. S. R., 38, p. 729) attention was called to the growth of young joints of a prickly pear (Opuntia) at 50 and 51.5° C. More recent investigations have shown that this plant may begin growth at 9° and extend to 55°, the young joints enduring a maximum of 55° (131° F.) for a period of an hour and a half, after which they resume elongation at lower temperatures with no perceptible aftereffects. This is believed to be a new high record for growth in Opuntia and for other higher plants.

A battery of chambers with different automatically maintained temperatures, B. E. LIVINGSTON and H. S. FAWCETT (*Phytopathology, 10 (1920), No. 6, pp. 336–340*).—The authors describe an apparatus so designed as to give a number of maintained temperature chambers that may be operated simultaneously, for studies dealing with the relations of temperature to growth.

A preliminary note on the effect of waterings on the amount of acids secreted by the gram plant, D. L. SAHASRABUDDHE (*Agr. Jour. India, 15 (1920), No. 6, pp. 636–639*).—Restating conclusions obtained as the result of previous work (E. S. R., 34, p. 525), the author reports further data in tabular form with discussion. When the number of waterings of *Cicer arietinum* was increased the dry matter per plant and total acidity per plant also increased, while the percentage of acidity decreased.

The water-supplying power of the soil as related to the wilting of plants, B. E. Livingston and R. Koketsu (*Soil Sci., 9 (1920), No. 6, pp. 469–485*).—This paper reports a preliminary study of soil moisture conditions considered from a dynamic point of view, on account of their relation to the wilting of ordinary plants. The method employed involved the use of small, porous porcelain cones, all having approximately the same area of surface in contact with the soil.

Plants of *Coleus blumei* and of wheat were grown in the 12 different soils indicated. When the plants were in healthy condition the watering was discontinued and wilting permitted. At or about the critical stage of permanent wilting, the water-supplying power of the soil about the roots was determined by the new method. The average proved to be the same for Coleus as for wheat, although it was expected to differ markedly for different kinds of plants. The index of water-supplying power may be regarded as practically the same for all of the 12 soils used.

The relation of hairy leaf coverings to the resistance of leaves to transpiration, J. D. Sayre (*Ohio Jour. Sci., 20 (1920), No. 3, pp. 55–86, figs. 7*).—In this paper, containing details and tabulation of results obtained in the study previously noted (E. S. R., 44, p. 518), it is concluded that hairs as a protective covering against ordinary intensities of wind and light on mullein leaves may be disregarded. The internal water loss is from 20 to 40 times greater than the external or cuticular water loss. The removal of the hairs increases total transpiration only to the extent that the cuticular surface is more exposed and has no apparent effect on stomatal transpiration.

Some aspects of the salt requirements of young rice plants, R. B. Espino (*Philippine Jour. Sci., 16 (1920), No. 5, pp. 455–523, pl. 1, figs. 9*).—The studies herein reported deal with the mineral nutrition of lowland rice plants in solution cultures for the phase of their development represented by the three-week period following germination. They involve experimental data on the growth of the plants in three different types of solutions, which are indicated, with the main generalizations derived.

It was found that in rice plants a good growth of tops was generally accompanied by a good growth of roots.

The mechanism of injury and recovery of the cell, W. J. V. Osterhout (*Science, n. ser., 53 (1921), No. 1372, pp. 352–356*).—The author summarizes his experiments upon Laminaria, which are considered to show that the fundamental life processes in this plant appear to obey the laws of chemical dynamics.

Variations in cell fission frequency in roots of Pisum sativum, M. G. Stålfelt (*Svensk Bot. Tidskr., 13 (1919), No. 1, pp. 61–70*).—In cases studied, the author considers it probable that rhythm, as regards fission frequency, originates in a regulatory factor capable of being affected by the galvanic current.

Periodicity of elongation and cell division, R. C. Friesner (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 233, 234*).—A study of seedlings of *Cucurbita pepo*, *Lupinus albus*, *Pisum sativum*, *Zea everta*, *Vicia faba*, and *Allium cepa*, and of germinating bulbs of *A. cepa*, *A. canadense*, and *A. cernuum* showed that elongation proceeds in a wave-like manner. The waves are usually of short duration (two to three hours), and taken as a whole show little uniformity as to the times of occurrence of the low and high points. The outstanding conclusion is that there are definite waves or rhythms in both elongation and cell division of these plants, even under constant environmental conditions, but that there is no

uniformity in the various curves as regards the clock time of their high and low points.

Daily rhythms of elongation and cell division in certain roots, R. C. FRIESNER (*Amer. Jour. Bot., 7 (1920), No. 9, pp. 380–407, pls. 2*).—It is stated that under constant conditions elongation in all plants studied proceeds in a rhythmic manner, two or more waves occurring during the 24-hour period. A similar rhythm was noted in nuclear and cell division. Metabolic activity and not time of day determine the occurrence of maxima and minima. Elongation and cell division are reciprocals of each other, as regards time of maxima and minima. This reciprocal relation existing between elongation and cell division accounts for much of the rhythm found in these plants.

Root pressure, J. H. PRIESTLEY (*Abs. in Brit. Assoc. Adv. Sci. Rpt., 87 (1919), p. 337*).—An attempt is made to show that in the literature of this subject there already exist the data for a theory of the mechanism of root pressure which would appear reasonably adequate. This theory would enlist the services in the mechanism of root pressure of osmosis for the diffusion of water from root hair to the parenchyma bordering on the xylem; the structure of the endodermis; and the behavior of a colloid gel in respect to its varying permeability toward water.

Greening in roots, A. SIEBERT (*Bot. Centbl., Beihefte, 37 (1920), 1. Abt., No. 2, pp. 185–216*).—Normal roots of 46 out of 58 plants were able to develop chlorophyll on exposure to light. The legumes furnished excellent examples of this, in particular *Vicia pisiformis.*

Formaldehyde as a transition stage in plants, M. JACOBY (*Biochem. Ztschr., 101 (1919), No. 1–3, pp. 1–6*).—Tabular data are held to indicate that formaldehyde, probably an end product of true assimilation, is fixed by the plant, though it is not determined into what product it first enters.

[Oxalic acid in plants], N. PATSCHOVSKY (*Bot. Centbl., Beihefte, 37 (1920), 1. Abt., No. 3, pp. 259–380, figs. 3*).—This is an elaborate account of the presence and significance of oxalic acid in plants throughout a wide systematic range.

The influence of arsenious acid on growing [plant] tissue, R. COBET (*Biochem. Ztschr., 98 (1919), No. 4–6, pp. 294–313*).—Arsenious acid at a concentration of 1:200,000 is strongly poisonous, dwarfing and killing roots. The weaker concentrations were not found to favor growth. Lower animals were more resistant than plants to the injurious effects of arsenious acid.

FIELD CROPS.

Further experiments in field technique in plat tests, A. C. ARNY (*Jour. Agr. Research [U. S.], 21 (1921), No. 7, pp. 483–500, pl. 1*).—In this contribution from the Minnesota Experiment Station data supplementing previous work (E. S. R., 40, p. 226) are presented concerning the effect of 18-in. alleys on the first, second, and third rows of plats of oats, wheat, and barley varieties. The varieties were uniformly seeded in plats of 17 6-in. drill rows 129 ft. in length at the University Farm. Rate of seeding tests with oats were sown at rates ranging from 48 to 112 lbs. per acre in 17 6-in. drill rows 132 ft. long at the University Farm and in 12 6-in. drill rows 130 ft. long at the Morris Substation. In the variety tests 3 rows on either side of each plat were harvested and thrashed separately and are referred to as outside, middle, and inside border rows, respectively. In the rate of seeding tests the 2 border rows removed from either side of each plat and treated separately are referred to as outside and inside border rows. The rows remaining after the removal of the border rows in both tests are indicated as central rows.

Subject to the influence of environment and varying somewhat with the crop, the effect of 18-in. cultivated alleys on the outside rows of plats appeared to be quite uniform and marked. The effect on the second 6-in. drill rows within the border of the plats was evidently more variable, ranging in the 1917 variety test from 123.2 per cent in oats to 149.3 per cent in wheat and 150.3 per cent in barley, based on the average yields of the central rows. In 1918 the second rows averaged 109.8 per cent for oats, 116.6 per cent for wheat, and 118.5 per cent for barley. In the rate of seeding tests at Morris the second or inside border rows yielded at the rate of from 152.7 per cent for the thinnest seeding to 123 per cent for the thickest, based on the yields of the central rows. The greatest border effect on the second rows appeared in the thinnest-sown and the least in the thickest-sown plats. In the rate of seeding test at the University Farm no effect on the second rows was apparent. The third rows, inside border rows of the 1918 test, yielding at the rate of 106.1 per cent for oats, 113.7 per cent for wheat, and 108.6 per cent for barley, based on the central row yields, were affected slightly less than the second rows for each crop. The removal of the border rows did not necessarily reduce the probable error in the tests.

"From the data given, unless border effect can be prevented in some other way, it appears advisable as a precaution to insure the most reliable results to remove at least two 6-in. border rows from either side of grain plats bounded by alleys or roadways."

The field experiment, T. Roemer (*Arb. Deut. Landw. Gesell., No. 302 (1920), pp. 69, figs. 2*).—A critical study of the physical and mathematical fundamentals involved in conducting field tests is presented, together with a résumé of the development of the technique of field experiments and a discussion of the methods of Von Rümker et al. (E. S. R., 26, p. 436; 31, p. 830). A concluding statement by B. Baule on the question of "average" or "probable variation" is appended, together with a list of 144 titles on the subject of field trials.

Fertilizer requirements of rotations including corn, potatoes, rye, and hay, B. L. Hartwell and S. C. Damon (*Rhode Island Sta. Bul. 185 (1921), pp. 39, fig. 1*).—Supplementing work already noted (E. S. R., 36, p. 528), further results of investigations with different crop rotations and fertilizer studies involved therein are reported.

Regardless of the manure and fertilizer used, the average yields of corn in the several rotations ranged only from 61 to 63 bu. per acre. Corn on second-year grass sod yielded about the same whether clover was included in or omitted from the first-year grass. Potatoes in the 3-year rotation potatoes, rye and rowen, and hay returned smaller annual yields than when following corn in contiguous rotations. Potato yields averaged about the same whether grass sod was plowed under in the fall or spring in preparation for the crop. Rye yields averaged from 24 to 26 bu. in the various rotations.

With the exception of hay, no advantage in crop yield was noted in favor of the legume rotation. The first-year hay following rye averaged 3.83 tons per acre in the rotations where it contained clover and 2.66 tons in the rotation including no legumes. The second-year grass was reduced from 4.29 to 3.1 tons by the previous omission of the clover. The hay in one round of the rotation contained 132 lbs. more nitrogen per acre in the case of the 5-year rotation including clover than in the similar 5-year rotation where this crop was omitted.

The results of two rounds of a 7-year rotation of potatoes, corn, and five years of hay and the experimental details of plats receiving different amounts of nitrogen, potassium, and phosphorus are included, together with observations on the fertilizer needs of the different crops grown in rotation without manures.

[Work with field crops on the Scottsbluff, Nebr., Reclamation Project Experiment Farm in 1918 and 1919], J. A. HOLDEN (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 7–10, 11, 12, 17–26, 27–34*).—The experimental work reported was conducted along the same general lines as noted heretofore (E. S. R., 40, p. 430). Agricultural conditions in the region are described, together with a statistical summary of acreage, yields, and farm values of the principal crops grown on the North Platte reclamation project from 1910 to 1919, inclusive.

Irrigated alfalfa spring seeded on beet land gave a 6-year average acre yield of 1.51 tons, as compared with 3.21 tons from that fall seeded in oat stubble, and 5.22 tons for second and third year alfalfa. Spring seeding is deemed justifiable only as a means of avoiding grasshopper injury. Alfalfa land pastured to hogs during 1914 and 1915 produced 316.1 bu. of potatoes in 1916, 18.29 tons of beets in 1917, 79.5 bu. of oats in 1918, and 41.9 bu. of barley in 1919, as compared with 288.8 bu. potatoes, 16.72 tons of beets, 60.8 bu. of oats, and 23.4 bu. of barley during the same period from land producing alfalfa hay in 1914 and 1915.

Sugar beets thinned at the ordinary time and 10 and 20 days later gave 3-year average acre yields of 18.4, 16.8, and 13.32 tons, respectively. The decrease in the value of the crop, due to late thinning, is estimated to have been $45.80 per acre where the thinning was delayed 20 days. Sugar beets following manure gave an average increase of 5.75 tons per acre, and following alfalfa the second and third season after the alfalfa was plowed up 6.19 tons per acre more than the check. Rather inconclusive fertilizer and manure trials with sugar beets are also noted.

Giant Half-Sugar with an average yield of 27.06 tons was the first of mangel varieties tested.

Downing, with a 3-year average acre yield of 401.7 bu., led potato varieties, and Rural, with 397.2 bu., and Eureka, with 362.4 bu., were next in order. Results of planting tests generally indicate that late plantings give smaller yields, but the tubers are of better grade. Potatoes following alfalfa in irrigated rotation experiments gave a 6-year average yield of 282.2 bu., and following manure 207.6 bu., as compared with 151.5 bu. from the untreated check.

Calico corn from local seed averaged per acre 66.9 bu. well matured as compared with 48.1 bu. of very soft corn from eastern Nebraska seed. Dry-Land White with 63.3 bu. led the variety test. Comparative trials indicate that sunflowers will yield more silage than silage corn, and that silage corn will outyield field corn. Available data led to the belief that the extra tonnage from silage corn will more than make up for the better quality of the field corn, and that the silage from silage corn is sufficiently higher in quality to offset the greater yield of sunflowers.

Leaders in the cereal variety tests with average acre yields include Arnautka (durum) wheat 43.9 bu., Galgalos wheat 40.1 bu., Trebi barley 70.7 bu., and White Kherson oats 65 bu. Oats on corn-stubble land plowed, disked, and spring-tooth harrowed averaged 77.9, 81.5, and 82.6 bu. per acre, respectively. Barley on land receiving the same treatments returned 66.9, 65.4, and 62.7 bu., respectively. When the cost of operations is considered, disking is indicated as the best method of preparing corn stubble land for seeding oats and barley.

In the unirrigated experiments conducted by the Office of Dry-Land Agriculture, winter wheat averaged 9.7 bu. per acre, spring wheat 10.7 bu., oats 21.4 bu., barley 13.4 bu., corn 19.6 bu., and sorghum 5,695 lbs. during the period 1911 to 1919, inclusive.

Red clover consistently resulted in total failure. Although brome-grass did not make a stand when seeded with a grain crop, when seeded alone it made a sod that in the second and third years averaged from 700 to 800 lbs. of hay. Alfalfa has given an average yield of about 1,200 lbs. of hay per acre. The increased yields obtained by breaking up alfalfa under irrigation were not evidenced on dry land.

Results of the experiments without irrigation indicate that the small grains can be grown successfully on either fallow ground or following corn, but their yields following small grains are too low to warrant their growth in such combinations unless at seeding time the soil is thoroughly wet to a depth of at least 3 ft. Fallow land should be seeded to winter wheat.

Corn did not show sufficient increase on fallow ground to justify fallowing for that crop. Corn grown continuously on the same land gave yields somewhat heavier than when following the small grains. For forage alone sorghum is the most productive and certain crop that has been grown.

[Report of field crops work in Nebraska] (*Nebraska Sta. Rpt. 1920, pp. 12–14, 29, 30, 31–35*).—Studies of various methods of corn breeding failed to show the possibility of a material increase in yield where a well adapted variety is already being grown. Although no harmful effects to the current crop appear where fertilization is made from the pollen of the same stalk, detriment may result in the progeny of such seed and rapid degeneration follow thereafter. Some strains of corn degenerate more rapidly than others.

Data secured in studies of water requirements of crops (E. S. R., 35, p. 823; 38, p. 228) did not indicate significant superiority of one variety of corn over another, based on economy in the use of water per unit of dry matter produced. Considering grain production only, varieties which produce a heavier percentage of grain and a lighter percentage of foliage might appear advantageous, but when based upon units of dry matter produced, special efficiency in alleged drought resistant varieties is not evidenced. The regional adaptation of corn (E. S. R., 45, p. 230) results in regional types which differ in total water used per plant rather than in water economy per unit dry matter. The water requirements of corn and sorghums are similar, being less than those of small grains, which, in turn, are less than those of sunflowers. Based upon unit of dry matter the density of the soil solution affects the water requirements of plants. The water requirement decreased with an increase in strength of the soil solution until the optimum density was reached, above which point more water per unit of dry matter was required, indicating a pathological condition of the plant. Plants grown in soils low in fertility required an increased amount of water.

In work at North Platte Substation, continuing that noted previously (E. S. R., 43, p. 637), winter wheat following summer tillage, corn, and wheat, produced 29.6, 28.6, and 25 bu. per acre, respectively. Kanred led the variety test of winter wheat with 43.2 bu. per acre. Durum spring wheat gave about two-thirds the winter wheat yield, and common spring wheat made less than half the durum yield. The highest oats yield, 48.5 bu. per acre, was made on spring plowed corn ground.

Variety tests at the Valentine Substation with millets, sorghums, corn, beans, and potatoes are briefly noted. Mammoth Russian sunflowers on valley land yielded 5 tons, as compared with 3.2 tons from corn.

At Scottsbluff potatoes on manured plats made 232.3 bu. and on alfalfa plats 340.4 bu. as compared with 123.4 bu. from check plats receiving no manure or alfalfa. Sugar beets on plowed ground averaged 1.14 tons more per acre than where the land had been disked and prepared without plowing. When the land

was plowed 1 day and 2, 3, and 4 weeks before planting, sugar beets yielded 14.3, 12.53, 11.33, and 10.57 tons per acre, respectively, showing a decided advantage in plowing immediately before planting. The 6 year average yields of beets, unmanured, manured, and following alfalfa were 10.48 tons, 16.76, and 16.8 tons per acre, respectively.

[Field crops work in Ireland in 1920] (*Ireland Dept. Agr. and Tech. Instr., Jour., 21 (1921), No. 1, pp. 38–68, pls. 4*).—Variety tests of wheat, oats, barley, flax, potatoes, mangels, and turnips; trials of pure line selections of wheat, oats, barley, and flax; fertilizer tests with oats, wheat, potatoes, and mangels; and cultural and cooking tests with potatoes conducted at various centers in Ireland are reported for the year 1920.

[Report of field crops work in India, 1918–19] (*Rpt. Prog. Agr. India, 1918–19, pp. 12–48, 52–56*).—The progress of investigational work conducted by the Imperial and Provincial Departments of Agriculture in various centers in India with rice, wheat, cotton, sugar cane, jute, and other fibers, tobacco, oil seeds, fodder crops and grasses, and miscellaneous cereals, legumes, and root crops is reported in summary form for the year 1918–19.

[Report of field crops work in Madras, 1919–20], L. D. Swamikannu (*Madras Dept. Agr. Rpt., 1919–20, pp. 6–11, 12, 14, 15, 17–20*).—Variety, fertilizer, and cultural trials and rotation tests with sugar cane, cotton, rice, and miscellaneous grain and forage crops are described in continuation of similar work noted heretofore (E. S. R., 42, p. 436).

Double germination of cereals, W. Hansen (*Deut. Landw. Presse, 47 (1920), No. 95, p. 647, fig. 1*).—In the hand-planted breeding plats at Mahndorf, double-germ grains occurred in Mahndorfer winter wheat at the rate of 1:10,000 and in Mahndorfer oats at the rate of 1:20,000, none being found in Bordeaux spring wheat or Hannchen barley. The greatest number was found in rye, one strain possessing about 7 per cent of double germs, while members of its F_2 generation possessed from less than 1 per cent to nearly 4 per cent of double-germ kernels.

Culture of Atriplex semibaccata [in Chile], A. Opazo G. (*Dir. Jen. Serv. Agr. [Chile] Bol. 65 (1920), pp. 15, figs. 3*).—Detailed information is presented regarding the culture and utilization of Australian saltbush (*A. semibaccata*) in Chile.

Barley hybridization, G. von Ubisch (*Landw. Jahrb., 53 (1919), pp. 191–244, pls. 3, figs. 18*).—Barley hybridization work is reviewed, and instructions on the technique of crossing are presented. The author describes the behavior of hybrids made between a 2-rowed beardless and a 6-rowed bearded barley in an effort to obtain a constant type of 2-rowed bearded brewing barley. Observations on the behavior of various characters, comprising nature of basal bristles, toothing of bristles, length of awns, density and brittleness of spike, and length of stalk are included, together with notes on the correlation between stalk length and length of awn and spike density. The gametic composition of the different combinations of hybrids, with respect to characters studied, are tabulated and discussed. Work along the same line has been noted (E. S. R., 42, p. 32).

Study of the successive selected generations showed the relation of 2-rowed bearded segregates to the 2-rowed bearded constant forms to run as follows: In the F_2 generation 56.3 per cent: 6.3 per cent; F_3, 69.4: 25; F_4, 81: 49; F_5, 89.3: 69.5; F_6, 94.2: 83.1; F_7, 97: 91.2; F_8, 98.5: 95.6; F_9, 99.2: 97.7; and F_{10}, 99.6 per cent: 98.9 per cent.

Italian clover seed is not adapted to Indiana soils, A. T. Wiancko (*Seed World, 9 (1921), No. 11, p. 23*).—Although equally good stands were secured at the Indiana Experiment Station from imported Italian clover seed as with

native seed from Indiana, Ohio, and North and South Dakota, and an unusually mild winter was encountered, the foreign seed died out completely. The native stock showed no winterkilling whatever and was in very fine condition the following spring. The result shows that Italian clover lacks winter hardiness and is not adapted to the region.

The genetic relations of plant colors in maize, R. A. EMERSON (*New York Cornell Sta. Mem. 39 (1921), pp. 7–156, pls. 11*).—An account of the genetic and environmental relations of six major plant-color types of corn, purple, sun red, dilute purple, dilute sun red, brown, and green (colorless), with the subtypes weak purple, weak sun red, green-anthered purple, green-anthered sun red, and five genotypes of green. The various color types are described and illustrated. Data involving examinations of about 680 progenies and 48,000 individual plants during a 10-year period are presented in an attempt at a factorial analysis of the several plant-color types.

The observations indicated that the sun red and dilute sun red types are dependent on light for the development of their color, while purple, dilute purple, and brown types develop characteristic colors in darkness. Diversities of temperature and soil moisture have no direct effect on the formation of maize plant colors, but affect them indirectly through the influence on soil fertility, which in turn bears a definite relation to the development of the purple-red series of plant color, anthocyanins, but little or no relation to brown. Sun colors particularly are markedly intensified by fertile soil. Although the several types of the purple-red series are sharply differentiated when grown on fertile soil, their characteristic differences are largely masked on infertile soil. On the other hand, the brown-green series is most readily distinguished from the purple-red series, especially in the seedling stage, if grown on infertile soil. It is suggested that the effect of infertile soil may be due to a deficiency of nitrogen and perhaps of phosphorus. Observations point to a close connection between the accumulation of carbohydrates and strong coloration.

The principal hypotheses involved conformed to observed facts when subjected to practically all available genetic tests, such as back crosses of F_1 with multiple recessives, behavior of F_2 types in later generations, intercrosses of the several F_2 types, relation of aleurone color to plant color, linkage of certain plant-color types with normal and liguleless-leaf types, and of other plant-color types with yellow and white endosperm. Approximately 32 per cent of crossing over is reported between the factors *Bb* and *Lg lg* and about 20 to 30 per cent between the factors *Pl pl* and *Yy*.

Study of the relation of the length of kernel to the yield of corn (Zea mays indentata), C. C. CUNNINGHAM (*Jour. Agr. Research [U. S.], 21 (1921), No. 7, pp. 427–438, pls. 8, fig. 1*).—Three lots of corn, one of ears with short, smooth, or dimpled kernels, another lot with kernels of maximum length with chaffy crowns, and a third of ears with kernels of medium length and wrinkle dented, were planted at the Kansas Experiment Station. The seed was continuously selected, smooth, rough, and medium ears being chosen each season from the progeny of smooth, rough, and medium ears, respectively. The smooth, medium, and rough types made respective 4-year average yields of 36.5, 34.8, and 35.5 bu. per acre.

Continuous selection of smooth and rather short kernels for four generations increased the average length of ears, slightly decreased the weight, and decreased the circumference, number of rows per ear, length of kernel, and percentage of shelled grain, while continuous selection of rough and rather long kernels decreased the average length of ear and increased the circumference, but had no significant effect on the weight of ears, number of rows per ear, length of kernel, or percentage of grain. From the data in this and other ex-

periments, the popular opinion that smoothness in corn indicates deterioration or reduced yielding capacity appears to be erroneous.

Corn experiments in south central Montana, A. E. SEAMANS (*Montana Sta. Bul. 140 (1921), pp. 24, figs. 7*).—The data presented show the response of corn to various cultural methods and rotations, and the relative merits of corn ground and summer fallow preparatory to small grain production. The experimental work was conducted in cooperation with the U. S. Department of Agriculture at the Huntley experiment farm during the period 1913 to 1920. Similar experiments in central Montana at the Judith Basin Substation have been noted (E. S. R., 43, p. 738).

Corn grown continuously with different methods of seed-bed preparation made the following average acre yields of ear corn and stover: Spring plowed, 19.7 bu., 1,578 lbs.; fall plowed, 19.1 bu., 1,810 lbs.; subsoiled, 19.5 bu., 2,130 lbs.; listed, 24.8 bu., 1,679 lbs.; and fallow, 29.4 bu., 2,776 lbs. Although summer fallow yielded highest, corn was grown only every second year, making the average annual yield but one-half the amount noted. While grain yields from fall plowing and spring plowing were similar, the stover yield was in favor of fall plowing.

After winter wheat, spring wheat, oats, barley, and flax, corn yields ranged from 22.5 bu. after barley to 20.8 bu. after flax, averaging 21.9 bu., a larger yield than when grown continuously. Barnyard manure did not increase grain yields, although stover yields were made slightly larger.

Winter wheat, spring wheat, oats, barley, and flax grown on fallow returned on the average 3.9, 4.3, 11.9, 1.7, and 3.8 bu., respectively, more than when grown on corn land. The culture of small grains on corn land is considered much more profitable than on bare fallow if the corn and stover are readily marketable.

The influence of fertilizers in corn culture, A. C. TONNELIER (*Min. Agr. [Argentina], Dir. Gen. Enseñanza Agr. [Pub.] No. 90 (1920), pp. 40*).—This describes studies of the effects of various combinations of commercial fertilizers, green manures, and animal manures on the corn yield in tests conducted in Argentina in the crop years 1909–10 to 1915–16, inclusive. Data on the experiments are tabulated and discussed in detail.

Maize for export, C. MAINWARING (*Rhodesia Agr. Jour., 18 (1921), No. 2, pp. 174–178, fig. 1*).—A brief discussion of methods of handling corn for export from Rhodesia, together with South African grades for white corn and corn meal.

Long-staple cotton, H. F. ASHURST (*Cong. Rec., 61 (1921), Nos. 25, pp. 1253–1267; 82, pp. 4471–4479*).—In this speech is included a paper entitled Cotton Production in the Irrigated Southwest in 1920, by C. S. Scofield, of the U. S. Department of Agriculture. The production of cotton in the irrigated districts of the Southwest in 1920 is described, with special reference to the Pecos, Rio Grande, Yuma, Imperial, Coachella, San Joaquin, and Salt River Valleys. The author treats in detail the agricultural and economic factors involved, including the development of the industry, types grown and areas cultivated, Pima Egyptian cotton, gins and ginning, labor conditions, cost of production, importance of increased yields, climatic difficulties, boll shedding, cotton production and other crop industries, syndicated cotton production, relations of manufacturers to cotton producers, seed supplies, and financing and marketing the crop.

Approximately 255,000 acres of upland cotton and 240,000 acres of Pima Egyptian cotton were grown under irrigation in the Southwestern States in 1920.

Report on fiber-yielding plants in northern Rhodesia, with special reference to sisal, J. DE JONG (*Rhodesia Resources Com. Rpt. 1921, pp. 89–107*).—

Information is presented regarding the adaptation, culture, diseases, preparation of fiber, and cost of production of sisal, Mauritius hemp, sansevieria, *Hibiscus cannabinus*, *Urena lobata*, and miscellaneous fiber plants in Rhodesia. See also previous notes (E. S. R., 39, p. 442; 40, p. 238; 41, p. 532; 43, p. 828).

Type and variability in kafir, A. B. Conner and R. E. Karper (*Texas Sta. Bul. 279 (1921), pp. 3–14, figs. 6*).—In black-hull kafir, 10 heads were selected from each of the extremes of number and length of seed-bearing branches, number of nodes to the head, and length of rachis or center stem, and the 8 groups grown in head-row plats and measurements recorded for the progeny. Selection for subsequent plantings within a group comprised 10 heads from a single row in that group whose progeny conformed to the highest standard for the particular character.

In every case the lines studied showed uniformity and purity in the F_2 generation, agreeing with the low percentage of cross-pollination found by the authors in open-pollinated heads (E. S. R., 42, p. 34). Variability was less in the several lines than in the populations, and was consistently uniform in the F_2 and succeeding generations. These results are held to lend greater reliability to earlier preliminary uncontrolled breeding work with the grain sorghums and to emphasize the value of the head-row method of breeding (E. S. R., 40, p. 737).

Varieties of oats tested in New South Wales, J. T. Pridham (*Agr. Gaz. N. S. Wales, 32 (1921), No. 4, pp. 249–252*).—Information is tabulated regarding 72 oat varieties and strains from different parts of the world tested by the New South Wales department of agriculture. The data include the season, character of leaves and straw, appearance of grain, origin, district for which suitable, distinguishing characters, good points, and defects of each variety.

Second annual report of the Nebraska Potato Improvement Association, H. O. Werner (*Nebr. Potato Impr. Assoc. Ann. Rpt., 2 (1920), pp. 116, figs. 36*).—Among the papers presented at the second annual meeting of the association, held at Kimball in November, 1920, were the following: Results with Potatoes Grown in Thirteen Different Rotations under Irrigation at the Scottsbluff Experiment Farm during the Past Nine Years, by J. A. Holden (pp. 8–13); Seed Potato Investigations with Western Nebraska Potatoes (pp. 31–52) and Irrigating Potatoes (pp. 91–97), both by H. O. Werner; Irrigated and Dry Land Potatoes Put to a Cooking Test, edited by H. O. Werner (pp. 74–77); Testing Northern Grown Triumph Seed Stock in the South, by W. Stuart (pp. 52–57); Seed Selection for the Control of Potato Disease, by R. W. Goss (pp. 67–74); and Summary of the Western Nebraska Potato Shipping Season 1920, by O. D. Miller (pp. 98–106).

Report of the work of the Rhenish Potato Research Institution in 1919, T. Remy (*Veröffentl. Landw. Kammer Rheinprov., No. 1 (1921), pp. 83*).—This reports the progress of potato experiments conducted in the Rhine Province in 1919, including variety, cultural, fertilizer, and rotation trials, and breeding work.

The tillering of Ceylon rices, F. Summers (*Trop. Agr. [Ceylon], 56 (1921), No. 2, pp. 67–86, pls. 8*).—Studies of the tillering of rice at Peradeniya and Anuradhapura Experiment Stations are reported, comparisons of broadcasted *v.* transplanted rice and seeded *v.* spaced rice, and correlations between tillering and maturity and yields being discussed in particular.

Results at Paradeniya indicate that, under methods employed by Ceylon cultivators, most of the plants in a crop possess either one or two good heads, an average of 1.9 panicles per plant being expected. When more than two are borne on a plant, one is generally immature and worthless. Where transplanted at 6-inch intervals an average of 4.2 tillers for all plants is indicated.

It is noted that transplanted rice produces a greater number of heads; tillering is more regular and can be expressed by a definite tiller mean, the aerial portion develops vigorously, and root development is very much greater than with broadcasted rice.

Selection experiments with rice under irrigation in Ceylon, F. SUMMERS (*Trop. Agr. [Ceylon], 56 (1921), No. 3, pp. 165–174, pl. 1*).—The author discusses the Ceylon rice varieties, their nomenclature, and the problems involved from the viewpoint of the plant breeder.

Soy beans in South Dakota, A. T. EVANS and M. FOWLDS (*South Dakota Sta. Bul. 193 (1921), pp. 317–324*).—The plant and its adaptations and varieties are described, and cultural and field practices suited to the production of the crop in South Dakota are outlined. Manchuria and Manchu with 22.5 and 21.5 bu. of seed, respectively, and 1.83 and 1.76 tons of hay were the leaders in the soy-bean variety tests.

Yellow Caledonia cane, E. D. COLÓN (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 10–15*).—Yellow Caledonia is described as an excellent sugar cane for Porto Rico. In tests at the Fajardo central, its average cane and sugar tonnage were 18 and 20.5 per cent, respectively, greater than the averages of Cristalina, native striped, and white canes.

Purchase of sugar cane on basis of sucrose content, I. A. COLÓN (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 37–42*).—In a discussion of transactions in sugar cane, the author holds that purchase on a sucrose content basis is far superior to buying cane by weight. Where the first method was tried at Vannina central, striking differences in sucrose content, ranging from 21 per cent to less than 10 per cent, were noted between different varieties of equal maturity. Heavy rains, especially after a prolonged drought, reduced the sucrose while not affecting purity of juice. Ratoon canes were generally sweeter than plant canes, although producing less tonnage, and canes from uplands were richer in sucrose than those from bottom lands. Chemical fertilizers did not affect the sucrose content in the least, although increasing the tonnage per acre.

For success with the practice, the cane should be milled as soon as possible, care being taken to secure representative samples, and the juice should be analyzed immediately.

The culture of tobacco in Greece, P. DIANA (*Bol. Tec. [R. Ist. Sci. Sper. Tobacco Scafati], 17 (1920), No. 4, pp. 403–411*).—A general discussion of tobacco culture in Greece, indicating the principal districts and their production and crop values.

Wheat culture in Argentina, C. D. GIROLA (*Pub. Mus. Agr. [Soc. Rural Argentina], No. 21, (1921), pp. 32, figs. 10; also in An. Soc. Rural Argentina, 55 (1921), No. 4, pp. 119–147, figs. 10*).—Important factors in the culture of wheat in Argentina are discussed, and the results reported of a contest in wheat culture in the crop year 1919–20 conducted by the Agricultural Museum of the Argentina Agricultural Society. The leading wheat varieties are illustrated and described in detail. The average acre yields of the principal wheats in the contest were as follows: Beardless 23.2 bu., Hungarian 26.7, Italian 23.3, Barleta 23.9, Chubut 15.2, durum 20.3, and Polish wheat 24.4 bu. The distribution of wheat culture in Argentina is indicated on outline maps.

Tests of crop preservatives, H. C. MÜLLER and E. MOLZ (*Landw. Jahrb., 52 (1918), No. 1, pp. 67–130, pls. 2*).—Tests of the efficiency of various commercial compounds, including color preparations, tar preparations, and aloes + Prussian blue, red lead, tar and carbolineum, different tar oils, and other substances in preventing the eating of winter and spring wheat and barley by birds are described.

The bird-repellant effect of commercial tar preparations, although generally good and superior to that of color preparations, did not equal that of coal tar. Coal tar, and to some extent, pyrrol-containing tar prevented bird damage, while lignite tar, deciduous tree tar, and vegetable tar were of very limited value, and of the tar oils, only heavy oil and crude base had an antibird effect. Red lead equaled tar preparations in effectiveness in many cases. None of these prevented mouse damage satisfactorily.

The tar preparations tested reduced the vigor of germination and growth mostly, and effected the rate to a lesser extent. Raw tar oil, phenol-free tar oil, light tar oil, and phenol and base-free tar oil modified the germination of winter wheat but slightly, while base-free (phenol-containing) tar oil, raw bases of the tar oils, raw phenol, and hard oil produced considerable damage. Color preparations and red lead had but slight effect on germination. While these and commercial tar preparations were ineffective against stinking smut of wheat (*Tilletia tritici*), coal tar A + pyrrol-containing tar in the proportion of 3:1 gave good results against this disease. Nearly all tar preparations were of value against *Helminthosporium gramineum*. The commercial tar preparations and coal tar A were superior to copper sulphate, formaldehyde, and corrosive sublimate, and neither impaired the power of germination nor reduced the field stand.

Effect of chloropicrin on seed, E. Miège (*Jour. Agr. Prat., n. ser., 35 (1921), No. 6, p. 108*).—The use of chloropicrin to destroy insects in granaries did not affect the seed of legumes, but reduced the germinability of cereals, particularly wheat, to a marked degree.

Purer seed for our customers, A. C. Wilson (*Seed World, 9 (1921), No. 11, pp. 13, 14*).—Practical suggestions are presented whereby commercial handlers of field seeds may cooperate with both producers and consumers to elevate the standard of the field seed industry.

[Seed and weed control in Wisconsin, 1918–20], A. L. Stone (*Wis. Dept. Agr. Bul. 33 (1920), pp. 81–102, figs. 9*).—The work of the seed and weed control division of the Wisconsin State Department of Agriculture is reported for the two-year period ended June 30, 1920, and tests of a machine for the prevention of seeding by Canada thistles are described. Analyses of 7,974 samples of seed were made in the period.

HORTICULTURE.

[Report on horticultural investigations] (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 5 (1919), pp. 8–18, fig. 1*).—In continuation of the work previously reported (E. S. R., 41, p. 339), data are given on the effect of position in the greenhouse on the yield of tomato plants, with the comment that variations due to this factor are often greater than those due to manures or sterilization. In the slow *v.* forced test with tomatoes, in contradiction to the results of the previous year, the slow plants gave the greater total but less profitable yield, in that the forced plants yielded heavier during the earlier part of the season, while prices were higher. A test of overhead damping *v.* dry treatment in the greenhouse indicated a beneficial influence of dampness on the setting of fruit in the case of the Comet tomato. Nitrogen decreased the yield of tomatoes in open beds by causing faulty setting of fruits. In pot tests, on the other hand, nitrogen gave increased yields.

Variations in yields of cucumbers due to fertilizers were not as great as those due to position in the house. A comparison of freshly dug *v.* stacked turf for cucumbers indicated a slight superiority in favor of the former. Soil sterilization again showed a marked beneficial effect on yields.

[Report on horticultural investigations] (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 6 (1920), pp. 8–16, 56–73, figs. 14*).—With the exception of completed experiments, the work of the year 1920 was largely a continuation of that noted above.

In the slow *v.* forced growth experiment with tomatoes, the forced plants not only gave the earlier and more valuable yield but also surpassed in total yield. Straw mulched tomato plants, although outyielded by the unmulched plants, showed the cleanest growth and least disease. Contrary to previous results, the presence of nitrogenous fertilizers increased the yield of tomatoes. The omission of potash was found to reduce the yield seriously.

Tabulated yields from a manurial test with cucumbers show the largest yield from a control plat, the soil of which consisted of two parts loam and one part dung.

The soil sterilization investigations are becoming complicated by the advent of other factors, deep trenching being required to restore the physical condition of the soil. Steam has given remarkable results for a while, but later is surpassed in efficiency by carbolic acid.

A summary of completed investigations is included as an extension of the summaries contained in the fourth annual report.

[Economic plants of the English Sudan], E. Perrot (*[Min. Com. et Indus.], Off. Natl. Matières Veg., Not. 5 (1920), pp. XII+72, pls. 17, figs. 3*).—A report of a commission delegated by the French minister of commerce and others to study the economic plants of the Anglo-Egyptian Sudan, in particular *Acacia verek*, the principal source of gum arabic. Following a review of commercial gum production throughout the world, comprehensive data are given on the production and marketing of gum in the Sudan. Other plants noted include senna, sorghum, chick-pea, sesame, and millet.

Some principles of orchard management, H. P. Gould (*Tenn. State Florists' Assoc., State Hort. Soc. [etc.], Proc., 14–15, (1919), pp. 179–196*).—A paper delivered before the Tennessee State Horticultural Society, at Nashville, Tenn., in December, 1919.

Fruit tree stocks used in propagation, H. P. Gould (*Tenn. State Florists' Assoc., State Hort. Soc. [etc.], Proc., 14–15 (1919), pp. 205–209*).—An address presented before the Tennessee State Nurserymen's Association in December, 1919, at Nashville, Tenn.

Recent developments in the practice and principles of pruning, J. K. Shaw (*Vt. State Hort. Soc. Ann. Rpt., 18 (1920), pp. 24–31, pl. 1*).—The author emphasizes the fact that heavy pruning delays fruiting and inhibits the growth of the apple tree. The statement is supported by the presentation of tabulated data procured in 1919 from a pruning experiment embracing 600 trees of five varieties, in which the greatest diameter increase was made by the unpruned trees.

The pruning of Rome Beauty, W. J. Allen (*Agr. Gaz. N. S. Wales, 32 (1921), No. 6, pp. 429–434, figs. 10*).—The peculiar fruiting habit of the Rome Beauty apple, in which much fruit is borne at the end of laterals, is commented upon, and a method of summer pruning of these laterals is outlined and illustrated which has given consistently satisfactory results at the Bathurst Experiment Farm Orchard.

The origin of the cider apples of France, A. Chevalier (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 11, pp. 521–523*).—Historical and botanical notes are given relative to the origin of the cider apple varieties of Normandy and Brittany.

Experiments in breeding plums, with a note on peaches, M. B. Crane (*Jour. Pomol., 2 (1921), No. 3, pp. 137–159, pls. 4, figs. 3*).—A paper from the

John Innes Horticultural Institution, Merton, England, presenting a preliminary report on a study in inheritance of morphological characters in the plum, peach, and nectarine. The material used was largely first generation, selfed seedlings of important commercial varieties. An earlier account, dealing with the practical phases of the investigation, has been previously noted (E. S. R., 44, p. 145).

An analysis of the data, presented in detail for each varietal family, shows great variability. In some of the families a wide range and diversity of types have appeared, showing the complexly heterozygous nature of the parents, while other families are very uniform and homozygous. Pollination studies indicated the dominance of self-fertility in a majority of the seedlings.

Crosses between varieties of *Prunus insititia* and *P. domestica* were found to always set fruit and develop seed freely. Attention is drawn to the existence of two forms of *P. cerasifera pissardi*, one of which is believed by the author to be heterozygous for the purple anthocyanin pigment of the leaves and the other homozygous for this character.

The " running off " of black currants, R. Wellington, R. G. Hatton, and J. Amos (*Jour. Pomol., 2 (1921), No. 3, pp. 160–198, pls. 4, figs. 7*).—A contribution from the East Malling Research Station, Kent, England, relating to an investigation of the causes of premature dropping of the fruit of black currants. It is stated that in certain seasons the crop has been diminished at least 50 per cent.

The elimination of other possible factors led to a thorough study of defective pollination, from which the following conclusions are deduced: "All varieties when healthy are completely self-fertile, so that cross fertilization is unnecessary. They are also equally cross-fertile. The period of blossoming during which the stigma is receptive and the anthers ripe is coincident and of considerable duration. . . . All these experiments demonstrated the only possible conclusion that the seasonal 'running off' on healthy bushes was due to inefficient pollination." As remedial measures the authors advise the selection of the right variety for particular conditions, the selection of sunny and sheltered situations to encourage insect activity, and the introduction of hive bees.

Travels in the land of dates, J. H. Fabre (*Un Voyage au Pays des Dattes. Toulouse: B. Sirven, 1920, pp. 44, figs. 12*).—A brief account of date production in Northern Africa, with comments on varieties, propagation, natural and artificial fecundation, and cultural considerations such as irrigation, etc.

Oaks for ornamental planting, F. L. Mulford (*Amer. Forestry, 27 (1921), No. 331, pp. 461–467, figs. 16*).—A short, illustrated article upon the merits and uses of several oak species for ornamental planting.

Evergreens, F. L. Mulford (*Amer. Forestry, 27 (1921), No. 332, pp. 497–501, figs. 6*).—A popular article pointing out some of the useful qualities of the evergreens and giving instructions relative to transplanting.

FORESTRY.

Report of the chief forester, W. G. Hastings (*Vt. Commr. Agr. [Bien.] Rpt. 10 (1919–20), pp. 77–120, pl. 1, figs. 5*).—A report for the biennial period from July 1, 1918, to June 30, 1920, relative to the depletion of timber resources, reforestation, forest protection, forest fires, blister rust control, and the administration of the State forests.

Grazing practice on the National Forests and its effect on natural conditions, C. F. Korstian (*Sci. Mo., 13 (1921), No. 3, pp. 275–281, figs. 7*).—The grazing of the national forest lands is deemed advisable, provided necessary

principles of management, briefly discussed, are followed, such as regulation of number of animals to a given area, proper rotation periods, etc.

Methods of communication adapted to forest protection, W. N. MILLAR (*Ottawa: Canada Dept. Int., Forestry Branch, 1920, pp. XVI+230, figs. 117*).—This manual deals in detail with the various methods of communication which experience has demonstrated to be best adapted for use in forest protection. Particular attention is given to instructions for the building of forest telephone lines. The standard methods of telephone communication in forests which have been developed by the Forest Service of the U. S. Department of Agriculture are described in detail, with slight modifications to fit Canadian conditions. Practically all of the diagrams and instructions as to telephone construction and maintenance are reproduced from Forest Service publications.

Observations upon forest tree studies, A. POSKIN (*Bul. Soc. Cent. Forest. Belg., 28 (1921), No. 8, pp. 389–398*).—The effect of various treatments on the viability of the seeds of conifers are discussed.

No essential difference was noted in the viability of seeds stored in sacks as compared with those in the cones. Seeds placed in hermetically sealed glass receptacles retained their viability much better and longer than those stored in sacks. The breaking of the seed envelope did not materially affect the germination. Seed of a single species obtained from several parts of Belgium varied markedly in weight and size but very slightly in percentage of germination.

The regeneration of sal (Shorea robusta) forests, R. S. HOLE (*Indian Forest Rec., 8 (1920), No. 2, pp. II+66, pls. 8, figs. 5*).—A further report of an ecological study of the factors influencing the development of sal seedlings, conducted at the Forest Research Institute, Dehra Dun, during the period 1909–1919 (E. S. R. 36, p. 844). The principal purpose of the work was to ascertain a method of accelerating the growth of the seedings and thus hastening the regeneration of the forests. The effect of fallen leaves, depth of planting, drought, moisture, aeration, light, shade, removal of weeds, etc., are discussed, and a cultural system is outlined, the pursuance of which will, it is believed, reduce the regeneration period by not less than 35 years.

The hard pines of the Northeast, J. S. ILLICK (*Amer. Forestry, 27 (1921), No. 332, pp. 487–496, figs. 18*).—Five species of pine, commonly known as northern jack, red, pitch, Jersey or scrub, and Table Mountain pines, and popularly classified as hard pines, are illustrated and discussed in relation to their distribution, habits of growth, and economic value. A needle and a cone key are given for the species.

The exploitation of the oil palm on the west coast of Africa, L. POIRATON (*Agron. Colon., 5 (1920), Nos. 31, pp. 9–20, pl. 1, figs. 2; 32, pp. 36–51, figs. 6*).—A discussion of the oil palm industry on the West African coast, its present status, potential possibilities, and the factors hindering this development.

The forests and wood industries of Sweden, C. BERG (*Stockholm: Skand. Kreditaktiebol., 1920, pp. 1–5*).—A statistical report, in English, relative to the production and exportation of lumber and timber of Sweden.

DISEASES OF PLANTS.

Diseases of economic plants, F. L. STEVENS and J. G. HALL (*New York: Macmillan Co., 1921, rev. ed., pp. VI+507, figs. 243*).—This revision by Stevens is the second edition of the textbook previously noted (E. S. R., 24, p. 345). It is designed primarily for college students, but is also for others who may wish by its use as handbook to recognize plant diseases or to apply treatments. It aims to give a comprehensive view of the field with diagnostic symptoms and

treatment of the more important diseases found on crop plants of the continental United States, and of a few others. The present edition includes a number of diseases and modifications of treatment that did not appear in the earlier edition. A bibliography containing 556 references is given.

Plant diseases and fungi comparatively new or rare in Ontario, R. E. STONE and J. E. HOWITT (*Abs. in Phytopathology, 10 (1920), No. 5, pp. 317, 318*).—Notes are given of a number of diseases observed in Ontario, among them a new stem rot of tomatoes due to *Botrytis* sp., blight of tomato seedlings through attacks of *Phytophthora infestans*, bean mosaic, cucumber mosaic, leaf spot and shot hole of cherries and plums, snapdragon rust, leaf spot and streak of barley, a Fusarium-like disease of barley, and witches' broom of black spruce due to the dwarf mistletoe (*Arceuthobium pusillum*).

The killing of shade trees by the placing of a band soaked in kerosene about the trees is reported.

[Plant diseases, Barbados], B. A. BOURNE (*Barbados Dept. Agr. Rpt. 1919–20, pp. 15–17*).—Condensed information is given regarding a number of diseases of sugar cane and concerning other crops attacked by fungi or nematodes.

Report of the mycologist [Gold Coast of Africa], R. H. BUNTING (*Govt. Gold Coast, Agr. Dept. Rpt. 1919, pp. 20, 21*).—Some advance was made during the year by the discovery of a hitherto undescribed fungus cause of a disease destroying cacao pods and beans, and transmissible by artificial inoculations. The fungus appears to be the same as that causing coffee berry disease. Inoculation experiments with the white thread fungus on cacao trees at Aburi produced slight results. A coconut-stem bleeding disease was reported from Assuantsi.

Chemical composition of lime-sulphur sprays for plant diseases and insects, V. VERMOREL and E. DANTONY (*Composition Chimique des Bouillies Sulfo-Calciques Employees Contre les Insectes et les Maladies des Plantes. Villefranche: Inst. Vermorel Sta. Expt. Recherches Agr., 1919, pp. 20*).—This collection of data deals in considerable detail with the preparation and properties of lime sulphur and its employment as insecticide and fungicide.

Penicillium spiculisporum, a new ascogenous fungus, S. G. LEHMAN (*Mycologia, 12 (1920), No. 5, pp. 268–274, pl. 1*).—An account with technical description is given of *P. spiculisporum* n. sp., said to have been found in rootlets of otherwise apparently sound cotton plants in Anson County, N. C.

Puccinia graminis on native Berberis canadensis, E. C. STAKMAN and L. J. KRAKOVER (*Phytopathology, 10 (1920), No. 5, pp. 305, 306*).—The authors report the occurrence of naturally infected specimens of *B. canadensis* in southern West Virginia and in Virginia.

Host alteration and specialization in Puccinia caricis, J. ERIKSSON (*Centbl. Bakt. [etc.], 2. Abt., 50 (1920), No. 20–25, pp. 441–443*).—The author has divided *P. caricis* into the new forms *P. caricis urticae* and *P. caricis ribis.*

Coix smut, C. C. THOMAS (*Phytopathology, 10 (1920), No. 6, pp. 331–333, fig. 1*).—The author reports the occurrence of coix smut (*Ustilago coicis*) on plants grown from a lot of seed of *Coix lachryma jobi* received from the Philippine Islands. As the life history of the causal organism is not completely known, it is considered impossible to say whether the disease was introduced by spores on the seed or by dormant mycelium within them.

A new corn smut in Washington, B. F. DANA and G. L. ZUNDEL (*Phytopathology, 10 (1920), No. 6, pp. 328–330, figs. 4*).—The authors report the occurrence of *Sphacelotheca reiliana* on corn in the vicinity of Pullman, Wash. A popular account of this smut has already been noted (E. S. R., 43, p. 242).

Overcoming root rot by breeding, W. D. VALLEAU (*Abs. in Science, n. ser., 53 (1921), No. 1371, p. 345*).—The author claims that differences in the time of death of plants of a given variety under field conditions are dependent on differences in resistance of the plants to root rot, and are not the result of planting diseased or disease-free seed. It was found that infection of corn takes place before the milk stage, and that ears may be graded according to resistance by growing seedlings in a sand box and noting the time required for the individual seedlings to rot to the surface of the sand. By this method he claims to have reduced the death of the seedlings by rot from an average of 36.1 in the checks to 8.4 per cent in the plants from the most resistant ears. Preliminary experiments are considered to indicate that field selections of seed from the longest-lived plants may prove a means of obtaining seed of a high degree of resistance.

Progress report on corn disease investigations, J. R. HOLBERT (*Abs. in Science, n. ser., 53 (1921), No. 1371, p. 345*).—Cooperative investigations conducted during the past three years are said to have shown that the root, stalk, and ear rot diseases of corn are widely distributed in this country. Wherever these diseases have been found they are a limiting factor to corn production.

A method of cereal seed treatment with copper sulphate, O. BECK (*Naturw. Ztschr. Forst u. Landw., 18 (1920), No. 3–4, pp. 83–99*).—It is concluded that the results following the use of copper sulphate on cereal seed for smut are not to be ascribed alone to the effects of the copper on such seed, but also to the agency of the seed in carrying copper to spores in the soil.

A barley bacteriosis, G. GENTNER (*Centbl. Bakt. [etc.], 2. Abt., 50 (1920), No. 20–25, pp. 428–441, figs. 2*).—Particularly in dry years, barley shows characteristic disease symptoms which are here described as due to *Bacillus cerealium*.

Three winter wheat varieties resistant to leaf rust in Kansas, L. E. MELCHERS and J. H. PARKER (*Phytopathology, 10 (1920), No. 3, pp. 164–171, figs. 3*).—A detailed account is given of investigations previously reported (E. S. R., 44, p. 539), in which Kanred (P 762), P1066, and P1068 are said to be resistant in a marked degree to *Puccinia graminis tritici*.

Rust and the weather, H. L. WALSTER (*Abs. in Science, n. ser., 53 (1921), No. 1371, p. 346*).—The author reports that at Fargo, N. Dak., Bluestem spring wheat averaged 7.1 bu. per acre in 5 seasons when rust epidemics occurred, and 26.7 bu. per acre in 5 nonrust seasons. Data are presented showing the average differences in temperature for each 10-day period after seeding, from which it appears that during rust years maximal temperatures rose more rapidly and reached their highest point sooner than in nonrust years. When high rainfall occurred in good years danger of rust was offset by low temperatures. When excessively high temperatures occurred during good years danger of rust was offset by droughty conditions.

Asparagus root rot, H. BLIN (*Rev. Hort. [Paris], 91 (1919), No. 20, pp. 325, 326, fig. 1*).—A root rot of asparagus (*Rhizoctonia violacea*) causes losses in localities indicated.

Inheritance of disease resistance in the common bean, G. P. MCROSTIE (*Abs. in Phytopathology, 10 (1920), No. 5, p. 319*).—A study is made of inheritance, as indicated by crosses between resistant and susceptible beans of resistance to anthracnose (*Colletotrichum lindemuthianum*), dry root rot (*Fusarium phaseoli*), and mosaic disease. Resistance to anthracnose was found to be dominant over susceptibility, while with the other two diseases susceptibility was partially dominant over resistance.

Observations on seed transmission of the cabbage black rot organism, J. C. WALKER and W. B. TISDALE (*Phytopathology, 10 (1920), No. 3, pp. 175–177*).—The authors state that the transmission of the cabbage black rot organism (*Bacterium campestre*) through seed has hitherto been generally assumed, but

that they now offer direct evidence confirming this assumption. A number of outbreaks of disease in different localities of Wisconsin were traced to the same source of seed, and where the seed had been treated with a solution of corrosive sublimate practically no disease resulted. In several instances where plants from infected and noninfected strains were grown in the same seed bed it was shown that the organism had been introduced with the seed rather than by way of the soil.

Some insect relations of Bacillus tracheiphilus, F. V. RAND and L. C. CASH (*Phytopathology, 10 (1920), No. 3, pp. 133–140, fig. 1*).—The studies on insect transmission of bacterial wilt of cucurbits, which have been interrupted for some time, have been resumed and the authors give additional data supplementing the account previously reported (E. S. R., 43, p. 245). It is claimed that a small percentage of striped cucumber beetles harbor the wilt organism internally when they enter the cucurbit fields in the spring, and there appears to be no other source of infection than the cucurbit crop of the preceding autumn. Infections may take place from the mouth parts, at least for a limited time after the insects have fed upon wilted plants, and infections are also shown to occur when the feces of some beetles come into contact with fresh injuries to the leaves. The organism has been isolated directly from the viscera of striped cucumber beetles which had fed on the wilted cucumber leaves. Some species of the genus Diabrotica have proved to be the carriers of the cucurbit wilt.

On forms of the hop (Humulus lupulus and H. americanus) resistant to mildew (Sphaerotheca humuli), IV, E. S. SALMON (*Ann. Appl. Biol., 6 (1920), No. 4, pp. 293–310*).—Having noted in previous articles (E. S. R., 44, p. 644) that resistance to mildew (*S. humuli*) is found in two forms of *H. lupulus* (the Golden hop and certain seedlings of the wild plant obtained from Italy), the author has now demonstrated the existence of a variety of *H. americanus* which is resistant to mildew. The present state of knowledge with respect to these three groups of mildew-resistant hops is detailed in this article.

Experiments upon formaldehyde-drip control of onion smut, J. C. WALKER (*Phytopathology, 10 (1920), No. 6, pp. 323–327*).—The author reports experiments conducted to determine the strength of solution and the amount of formaldehyde to be applied by the drip method for the control of onion smut. It was found that, for the region where the experiments were carried on, approximately 200 gal. of solution per acre would give the most satisfactory results, and there was no advantage in increasing the concentration above 1:128.

Pathogenicity of Corticium vagum on the potato as affected by soil temperature, B. L. RICHARDS (*Jour. Agr. Research [U. S.], 21 (1921), No. 7, pp. 459–482, pls. 6, figs. 5*).—In a contribution from the Utah Experiment Station, the author gives a report of some investigations on the effect of soil temperature in influencing the pathogenicity of *C. vagum* on the potato and other hosts. It was found that the fungus causes the greatest damage to the potato at a very early stage in the development of the host, probably before the young shoots appear above the soil. Two types of injury are recognized, the cankering of the cortex of the basal portions of the stem and the destruction of the primordia of the young shoots before they push through the soil.

The percentage of stem injury was not found to give a true index to the degree of damage produced by the fungus. The various strains of *C. vagum* introduced into the soil as a pure culture produced lesions on the basal portion of potato stems throughout the same range of soil temperature of from 9 to 27° C. The greatest damage occurred between 15 and 21°, while 18° proved to

be the most favorable temperature for tissue destruction as well as for growing-point injury. Serious destruction of tissue was observed at 9°, and the severity of attack decreased rapidly above 21° until at 24° *C. vagum* proved to be of minor parasitic importance.

Growing-point destruction was confined to temperatures at or below 21°. Beyond this temperature this type of injury was slight. On the other hand, it was found that it may reach its maximum expression at a temperature as low as 12°. Growing-point injury is said to be dependent upon the rate at which the young shoots grow through the soil. At temperatures above 21° the rapid growth of the potato, together with the decreased pathogenic power of the fungus, was found to permit the primordia of the young shoots to escape injury.

No critical temperature for the pathogenicity of the fungus on the potato appeared at the lower range of temperature used. The temperature requirements of the potato plant were found to vary with its different stages of growth. The young sprouts, while in the soil, grew most rapidly at 24°, and growth was greatly retarded at 15° and below. A soil temperature of approximately 18° proved optimum for the continued development of potato plants. This temperature was also most favorable for the pathogenic action of the fungus.

Causation of potato leaf roll, L. Hiltner (*Prakt. Bl. Pflanzenbau u. Schutz., n. ser., 17 (1919), No. 1–2, pp. 15–19*).—Potato leaf roll was associated with the absence of phosphorus (Thomas slag) and with the presence of abundant starch. The movement of starch is influenced by the presence and concentration of potassium compounds and the degree of their dissociation. The causation of leaf roll is to be sought finally, it is thought, in the causes of starch accumulation.

Some observations made in inspecting for leaf roll and mosaic, J. E. Howitt (*Abs. in Phytopathology, 10 (1920), No. 5, p. 316*).—According to the author, disease surveys of the potato-growing regions of southern and northern Ontario have been made and tests have been conducted for disease and yields of potato seed grown in northern and southern Ontario and in New Brunswick. Seed potatoes grown in northern Ontario are said to be freer from leaf roll and mosaic and to give larger yields per acre than those grown in southern Ontario and New Brunswick, where leaf roll seems to be especially prevalent and severe. In northern Ontario it is claimed that leaf roll does not seem to spread, nor to increase appreciably in amount from year to year in the same stock. In southern Ontario the mosaic disease appears to be suppressed in some years, no mosaic being observed from seed planted from mosaic stock. In northern Ontario there does not appear to be any suppression of mosaic, as the disease seems to appear in infected stock year after year. The mosaic disease is considered to spread from diseased to healthy plants in one year, and the chief agent in its transmission is the leaf hopper (*Empoasca mali*).

Potato wart, W. A. McCubbin (*Amer. Plant Pest Com. Bul. 5 [1921], pp. 8, figs. 5*).—An account is given of the introduction, history, and present occurrence of potato wart (*Chrysophlyctis endobiotica*) since its introduction in 1911 and 1912. In January, 1921, it was reported as present in 9 counties of Pennsylvania, 3 of Maryland, and 2 of West Virginia, but in no extensive potato-producing area.

The organism has been found to remain active in the soil for 8 years in Ireland and longer in Germany. It lives on tomato and nightshade, which serve to keep it alive in the absence of potato.

The hope of escape from the fungus appears to be through the use of immune varieties, the number of which is large and increasing.

New or little-known diseases of potatoes which cause "running-out" of seed, P. A. MURPHY (*Abs. in Phytopathology, 10 (1920), No. 5, pp. 316, 317*).—Descriptions are given of two diseases which are said to be comparable to the worst types of leaf roll or curly dwarf. The first disease, provisionally called crinkle, is characterized by dwarfed, light green, bushy plants, the leaves of which are strongly corrugated, curve downward at the tips, and are brittle. The second disease, which is called leaf drop, is said to cause extreme dwarfing, gradual death of the leaves from below upward, and premature death of the plant.

How certified seed potatoes will benefit the California potato industry, W. V. SHEAR (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 9, pp. 375–381, figs. 5*).—Brief descriptive discussion is given of such diseases of potato in California as curly dwarf, mosaic, leaf roll, and spindle sprout, with mention of such others as scab, Rhizoctonia, and Fusarium wilt. The most potato trouble is due to nematodes. The importance of rigid inspection is emphasized.

Head smut in sorghum and maize, W. W. MACKIE (*Phytopathology, 10 (1920), No. 5, pp. 307, 308*).—The occurrence of head smut (*Sorosporium reilianum*) on sorghum and maize in California is reported.

Bacterial blight of soy bean, F. A. WOLF (*Phytopathology, 10 (1920), No. 3, pp. 119–132, figs. 5*).—A description is given of bacterial blight of soy beans, which the author says was first reported in Nebraska in 1905 and has subsequently been reported from Connecticut, Wisconsin, and North Carolina. The lesions on the leaves are said to begin as small, angular, water-soaked areas, which enlarge and change in color, becoming dark brown to purplish-black. The infection is believed to spread from the cotyledon to the true leaves and from these to other leaves. The cause of the blight is said to be *Bacterium sojae* n. sp., a technical description of which is given. This disease is considered to differ in several respects from one previously described as due to *B. glycineum* (E. S. R., 42, p. 352).

Some problems in the pathology of sugar cane, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 32–36*).—Attention is called to some problems in connection with the diseases of sugar cane, particularly the mosaic disease, gummosis, and root diseases.

Sugar-cane blight in Trinidad, W. NOWELL and C. B. WILLIAMS (*Trinidad and Tobago Dept. Agr. Bul., 19 (1920), No. 1, pp. 8–10*).—This summary, prepared as a preliminary report of investigations during 1919 (E. S. R., 42, p. 745), deals in systematic detail with the froghopper, the root disease, and control measures.

The eradication of sugar cane mosaic in Fajardo, R. VEVE (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 52–55*).—The author gives an account of measures taken to control the mosaic disease of sugar cane in the District of Fajardo, Porto Rico. During 1919, 2,716 cane clumps were removed and destroyed as a result of 58 inspections, and in the same year about 30 acres of cane was abandoned on account of the disease. In 1920, 136 inspections were made and 1,453 clumps of cane removed. In this season no fields were abandoned on account of the disease.

Sweet potato stem rot and tomato wilt, L. L. HARTER and J. L. WEIMER (*Phytopathology, 10 (1920), No. 5, pp. 306, 307*).—On account of the belief that tomatoes following sweet potatoes in rotation become infected with wilt, the authors carried out a series of experiments in which tomato and sweet potato plants were inoculated with *Fusarium hyperoxysporum* and *F. lycopersici*, respectively. The results of the experiments show that the organisms were pathogenic to the host from which they were isolated, but that the sweet potato fungus was not pathogenic to tomatoes and vice versa.

The distribution of buckeye rot of tomatoes, J. L. WEIMER (*Phytopathology, 10 (1920), No. 3, p. 172*).—The author reports the occurrence of the buckeye rot of tomatoes, caused by *Phytophthora terrestria*, in Alexandria County, Va. This disease had previously been considered to be restricted to the extreme Southern States.

Damping-off and foot rot of tomato seedlings, W. F. BEWLEY (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 156–172*).—Damping-off of tomato seedlings is a communicable disease due to a group of pathogenic organisms, particularly species of the genus Phytophthora occuring in some soils.

Seedling infection comes primarily from the soil and from water, and may be carried over in seed beds. The soil may be completely freed from the disease by heat or formaldehyde.

Relation of horse nettle (Solanum carolinense) to leaf spot of tomato (Septoria lycopersici), F. J. PRITCHARD and W. S. PORTE (*Jour. Agr. Research [U. S.], 21 (1921), No. 7, pp. 501–506, pls. 5*).—The results are given of a study of the horse nettle, a common weed in fields and waste places in the eastern half of the United States, which usually bears numerous spots on its leaves resembling leaf spot of tomato. Inoculation experiments carried on by the authors in the Bureau of Plant Industry, U. S. Department of Agriculture, on more than 500 horse nettle seedlings with a pure culture of the tomato leaf spot fungus (*S. lycopersici*) caused infection of about 90 per cent of the plants.

Pycnidia developed quite freely on about 1 per cent of the spots on the inoculated plants, both in the greenhouse and outdoors, and the pycnidia and spores were indistinguishable from those of *S. lycopersici* on tomato.

A culture of Septoria reisolated from artificially infected horse nettle plants produced on both horse nettle and tomato leaves spots, pycnidia, and spores typical for *S. lycopersici*. Other fungi were found fruiting on horse nettle leaf spots, but it is considered likely that in the Middle Atlantic States at least the spots on the horse nettle resembling leaf spot of tomato are due to *S. lycopersici*.

Peronospora in turnip roots, M. W. GARDNER (*Phytopathology, 10 (1920), No. 6, pp. 321, 322, pl. 1*).—A report is given of an investigation of turnips in storage which showed the presence of *P. parasitica*. Inoculation experiments with the organism were made on seedlings of turnip, rutabaga, and radish, but no infections occurred on any of the plants but the turnip. The author believes that the presence of viable mycelium of this fungus in turnip roots late in the winter would indicate that it might live over winter in turnips which remain in the field.

A smut of western rye grass, W. P. FRASER (*Abs. in Phytopathology, 10 (1920), No. 5, p. 316*).—A description is given of the morphology and life history of a smut of western rye grass, which is said to be widely distributed in the prairie provinces of western Canada. The ordinary formalin treatment of the seed is said to have given perfect control.

Mycological studies.—I, On the spotting of apples in Great Britain, A. S. and E. V. HORNE (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 183–201, figs. 6*).—This paper presents results obtained in an investigation carried on since 1915 regarding spotting in apples. Several fungi have been isolated and cultivated, including a new genus of Phomatales (Polyopeus) and nine new species, of which at least one, *Pleospora pomorum*, has been shown to be capable of parasitizing apples. These fungi do not include any of the species hitherto reported as causing apple spotting disease.

On spotting in apples, A. S. and E. V. HORNE (*Gard. Chron., 3. ser., 68 (1920), No. 1766, pp. 216, 217, figs. 4*).—Known, probable, or possible causes of

spotting in apples, as reported in English counties named or from outside points and here briefly discussed, include *Cylindrosporium pomi*, *Pleospora pomorum*, *Alternaria grossulariae*, *A. pomicola*, *Polyporus purpureus*, *Leptosphaeria vagabunda*, *Coryneum foliicolum*, *Exoascus deformans*, *Sclerotinia fructigena*, *Glomerella cingulata*, and *Physalospora cydoniae*. Control measures carried out in different regions include spraying at appropriate seasons with Burgundy mixture, general sanitation, insect control, and storage sanitation combined with cold storage.

Some data on peach yellows and little peach in Ontario, L. Caesar (*Abs. in Phytopathology, 10 (1920), No. 5, p. 318*).—The author reports experiments conducted to determine methods of distribution of these diseases, in which it was found that the use of pits from diseased trees apparently is not a factor in distribution. Buds from infected trees inserted into healthy seedlings produced disease in the majority of cases, but not in all. Inoculating healthy trees with sap from crushed diseased fruit, leaves, and twigs did not produce the disease, nor did rubbing the bark of diseased branches against the bark of healthy trees produce the trouble, even after four years' interval. The presence of diseased trees in orchards, under some conditions at least, is held not to cause the neighboring trees to become diseased.

Varietal susceptibility to false blossom in cranberries, S. B. Fracker (*Phytopathology, 10 (1920), No. 3, pp. 173–175*).—The results are given of a survey in which the varietal susceptibility of cranberries to the disease known as false blossom was determined. Inspections made of a number or areas for the purpose of certifying the plants for propagation showed that about 20 per cent of the areas surveyed were infected. Very marked differences were shown as to the susceptibility of the different varieties, and the author recommends the choosing of resistant varieties, the securing of vigorous growth for new plantings from beds without a trace of the disease, and the adoption of cultural methods which will secure the largest returns in healthy bogs.

Decay in citrus fruits during transportation, O. F. Burger (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 9, pp. 365–370*).—The author sets forth that stem-end rot (*Phomopsis citri*) and blue mold are the most important diseases causing loss in citrus fruits arriving at retail centers, the former starting from infection in the field, the latter from improper handling on the way to market.

Iris leaf spot caused by Didymellina iridis, W. B. Tisdale (*Phytopathology, 10 (1920), No. 3, pp. 148–163, figs. 6*).—A leaf spot of Iris, which seems to be confined to the broad-leaved or German group, is described. This disease was studied in the vicinity of Madison, Wis., and has been reported as occurring in California, Kansas, New York, Ohio, and Wisconsin. It is also said to be one of the most serious and troublesome diseases of Iris in England.

The disease is caused by the conidial stage of the fungus, known as *Heterosporium gracile*, but as the ascigerous stage of the organism has been found, it has been referred to *D. iridis*. The fungus is said to overwinter in the mycelial stage in the dead leaves, developing in the spring an abundant crop of conidia which serve as the chief source of primary infection. The removal of the diseased leaves before the young leaves appear in the spring is believed to offer satisfactory means of control.

Observations on some common and important diseases of the Rhododendron, H. Schmitz (*Phytopathology, 10 (1920), No. 5, pp. 273–278, pl. 1*).—Descriptions are given of diseases of the Rhododendron due to *Sporocybe azaleae*, *Melampsoropsis piperiana*, witches' brooms, white leaf, *Lophodermium rhododendri*, *Coccomyces dentatus*, *Coryneum rhododendri*, *Sphaerella rhododendri*, *Pestalozzia guepini*, and *Cryptostictis* sp.

The Phyllosticta blight of snapdragon, E. M. SMILEY (*Phytopathology, 10 (1920), No. 4, pp. 232–248, figs. 8*).—The results are given of a study of diseased snapdragons observed in greenhouses at Batavia and Corfu, N. Y., in the spring of 1917. The same disease was observed in gardens at Ithaca, N. Y., in 1917, and again in 1918 on both garden and greenhouse plants. The investigation proved that the trouble was due to *P. antirrhini*, and the disease is considered to be identical with that previously described (E. S. R., 43, p. 658), although the investigation was carried on independently.

For the control of the disease the author recommends the removal of all débris, care in soil watering, and the proper ventilation of the greenhouse. Snapdragons should be grown in cool houses, as the plants do well at an average temperature of 15° C. (59° F.), while the fungus can not thrive at that temperature.

Phomopsis juniperovora, a new species causing blight of nursery cedars, G. G. HAHN (*Phytopathology, 10 (1920), No. 4, pp. 249–253, fig. 1*).—A description is given of *P. juniperovora* n. sp., which has been observed on juniper trees in Nebraska, Kansas, Illinois, Minnesota, Iowa, Ohio, New York, and Pennsylvania. In addition to junipers the parasitism has been proved positively on *Thuja occidentalis* and *T. orientalis*.

Butt rots of the balsam fir in Quebec Province, W. H. RANKIN (*Abs. in Phytopathology, 10 (1920), No. 5, pp. 314, 315*).—The author claims that the so-called butt-rot disease of balsam fir is a complex of diseases caused by many different fungi. The most prevalent and destructive butt rot is ascribed to *Fomes pinicola*. Butt rot is also caused by *Polyporus schweinitzii*, and a fungus provisionally determined as *F. pinicola* is said to be mixed with the butt rot caused by *P. schweinitzii*.

Witches' broom of the Canada balsam and the alternate hosts of the causal organism, R. E. STONE (*Abs. in Phytopathology, 10 (1920), No. 5, p. 315*).—Attention is called to the wide distribution of witches' broom of the Canada balsam, and cultural work has shown that the cause of witches' broom (*Peridermium elatinum*) had for its alternate hosts *Cerastium vulgatum* and *Stellaria media*. Attention is also called to witches' broom of the spruces, and preliminary work is believed to indicate that the causal organism belongs to the same species.

Occurrence of Keithia thujina in Ireland, A. C. FORBES (*Gard. Chron., 3. ser., 68 (1920), No. 1767, pp. 228, 229*).—Since the notice of *K. thujina* on *Thuja plicata* by Pethybridge (E. S. R., 43, p. 49) this disease has been found in various parts of Ireland, appearing to be widely distributed. In 1919 cases showing considerable severity were observed in two localities. The economic and other bearings of the situation are discussed.

The alternate stage of Pucciniastrum hydrangeae, J. F. ADAMS (*Mycologia, 12 (1920), No. 1, pp. 33–35*).—This contribution gives a description, with brief discussion, of *Peridermium hydrangeae* n. comb. as found on *Tsuga canadensis*.

Facultative Heteroecism in Peridermium cerebrum and P. harknessii, E. P. MEINECKE (*Phytopathology, 10 (1920), No. 5, pp. 279–297, figs. 2*).—In continuation of the report of the successful infections of *Pinus radiata* with aeciospores of *Peridermium harknessii* (E. S. R., 36, p. 454), the author reports the occurrence of *P. cerebrum* on *Pinus muricata* and *P. halepensis*. The host list of *Cronartium cerebrum* is said also to include *Quercus californica*. Direct infections with *Peridermium cerebrum* spores have been successful from *Pinus radiata* to *P. muricata* and from *P. attenuata to P. radiata*.

Peridermium harknessii is considered confined to the gall form occurring on mountain pines, though retaining its faculty easily to infect scrophulariaceous hosts from which direct inoculations can be made to various pines.

The heteroecism of *P. cerebrum* and *P. harknessii* is facultative.

Reinfection of pines with Peridermium pini, C. von Tubeuf (*Naturw. Ztschr. Forst u. Landw., 18 (1920), No. 3–4, pp. 99–101*).—In studies here briefly noted young pines and twigs of older pines, either wounded or unwounded, were infected directly with spores of *P. pini* (*Cronartium asclepiadeum*).

Abnormal growth induced by chloral hydrate soil treatment, C. Hartley (*Phytopathology, 10 (1920), No. 6, pp. 334, 335, fig. 1*).—In conducting experiments for the control of the damping-off disease of seedlings of western yellow pine the author tested a considerable number of materials and found that where the plats were treated with chloral hydrate abnormal growth resulted. The affected seedlings were taller than normal and the cotyledons and first juvenile needles were partially joined together, forming imperfect cylinders. The loss from damping-off in the chloral hydrate plats was heavier than in the untreated plats.

White pine blister rust, E. P. Meinecke (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 7, pp. 270–275*).—This is a discussion of the effectiveness of State and Federal nursery stock quarantines as protective of western pines against white pine blister rust.

Results of white pine blister rust control in 1919, S. B. Detwiler (*Phytopathology, 10 (1920), No. 3, pp. 177–180*).—The author reviews the work carried on in the New England States and in New York for the control of the white pine blister rust through the eradication of Ribes.

Report on white pine blister rust control, 1920, S. B. Detwiler and W. S. Moir (*Amer. Plant Pest Com. Bul. 6 [1921], pp. 8*).—Giving separate reports on white pine blister rust control and on recent observations made on American white pines in Europe, this paper includes resolutions of the Sixth International White Pine Blister Rust Conference and other information on this disease, as regards its origin, recent spread, dangers, control measures and cost thereof, the blister rust situation in Europe in 1920, and the need of energetic eradication measures and shipment control.

Needle blight of the white pine, J. H. Faull (*Abs. in Phytopathology, 10 (1920), No. 5, p. 315*).—The occurrence of a needle blight of the white pine in Ontario is reported. Experiments and observations are believed to show that the disease is physiological and related to root injury.

Notes on some diseases of aspen, C. Hartley and G. G. Hahn (*Phytopathology, 10 (1920), No. 3, pp. 141–147, figs. 3*).—Observations are reported which show that the quaking aspen in certain areas is unusually subject to disease, trunk cankers of unknown origin being important factors in shortening the life of the trees. An important factor in causing premature death of aspen in the Pikes Peak region of Colorado is said to be *Fomes igniarius*. Other less important diseases reported are a twig blight suggesting the fire blight of pear, a leaf disease due to *Sclerotium bifrons*, and a rapidly-spreading bark trouble which kills cuttings.

Giving medicine to trees, C. Rumbold (*Amer. Forestry, 26 (1920), No. 318, pp. 359–362, figs. 5; also in Sci. Amer. Mo., 2 (1920), No. 2, pp. 114–116, figs. 5*).—A condensed account is given of efforts to control chestnut blight, particularly of experiments conducted by the author. These include the injection of substances in solution (56 being tested for this purpose) into the tree trunks. Lithium carbonate and lithium hydroxid checked the disease, resulting in the formation of a callus separating the sick from the sound tissues and the final

drying out of the part formerly diseased. However, the lithium was gradually eliminated, and the trees were then found to be subject to reinfection. This work is regarded as being as yet in its preliminary stage.

A bacterial canker of poplar, R. RÉGNIER (*Rev. Hort.* [*Paris*], *91* (*1919*), *No. 21, p. 338*).—Occurrence is recorded of a poplar canker due to *Micrococcus populi* in the Garonne Valley. It is said to be particularly dangerous to young California poplars. Insects may act as carriers.

Napicladium tremulae: A new disease of the poplar, A. W. MCCALLUM (*Abs. in Phytopathology, 10* (*1920*), *No. 5, p. 318*).—This disease, which is said to be well known in Europe, is reported for the first time in Ontario and Quebec.

Sphaeronema sp. (moldy rot of the tapped surface), A. R. SANDERSON and H. SUTCLIFFE (*Ann. Appl. Biol., 7* (*1920*), *No. 1, pp. 56–65, pls. 4*).—Investigations begun in December, 1918, are said to have shown that the moldy rot of the tapped surface of Hevea rubber trees is due to a Sphaeronema of undetermined species, and not to a Cephalosporium or a Fusarium. The damage done by this disease, when neglected, is probably greater than that due to any other cause. The infection may be carried on the tapping knife or by insects, and often extends to many trees in a very few days. Methods of management to control infection are indicated.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The nature of animal light, E. N. HARVEY (*Philadelphia and London: J. B. Lippincott Co., 1920, pp. X+182, pls. 13, figs. 20*).—The several chapters of this work deal respectively with light-producing organisms, luminescence and incandescence, the physical nature of animal light, the structure of luminous organs, the chemistry of light production, and the dynamics of luminescence.

The nomenclature of supergeneric names, S. A. ROHWER (*Jour. Wash. Acad. Sci., 11* (*1921*), *No. 5, pp. 106–109*).

Dealing with the rodent pest, W. F. SCHLUPP (*So. African Jour. Indus., 3* (*1920*), *Nos. 11, pp. 1023–1029; 12, pp. 1142–1148*).—Formulas are given and the preparation and use of poison baits described.

A distributional list of the birds of Montana, with notes on the migration and nesting of the better known species, A. A. SAUNDERS (*Cooper Ornithol. Club, Pacific Coast Avifauna, No. 14* (*1921*), *pp. 194, figs. 35*).—This work includes a bibliography of 10 pages and a subject index.

The development of the Japanese blood fluke, Schistosoma japonicum Katsurada, in its final host, W. W. CORT (*Amer. Jour. Hyg., 1* (*1921*), *No. 1, pp. 1–38, pls. 4, figs. 3*).—The studies here reported, which are in continuation of those previously noted (E. S. R., 40, p. 554), deal particularly with the development of this fluke after the cercaria enters the final host.

Eleventh annual report of the State entomologist of Colorado, C. P. GILLETTE, G. M. LIST, ET AL. (*Colo. State Ent. Circ. 28* (*1920*), *pp. 46, pls. 2, figs. 14*).—Included in this report are notes on the occurrence of and work with insect and rodent pests and accounts of the beet webworm (*Loxostege sticticalis* L.) (pp. 16, 17), the fruit-tree leaf roller (*Archips argyrospila* Wlk.) (pp. 19–21), and shot-hole borers or fruit-tree bark beetles (p. 21), all by G. M. List; the variegated cutworm (*Peridroma saucia* Hubn.) (pp. 17–19); and a progress report for 1919 on the alfalfa weevil (pp. 22–34), by C. C. Wakeland. The annual cycles of the alfalfa weevil and its parasite *Bathyplectes curculionis* are illustrated in a colored plate.

Insect pests and plant diseases (*West Indies Imp. Dept. Agr., Grenada, Agr. Dept. Rpt., 1918–19, pp. 14–26*).—This includes a report by H. A. Ballou on the status of the cacao thrips (*Heliothrips rubrocinctus* Giard) in Grenada.

[Work with economic insects in Hawaii], H. P. AGEE (*Hawaii. Sugar Planters' Assoc. Proc., 39 (1919), pp. 143–150*).—In his report the director of the Sugar Planters' Experiment Station reviews the work of the year with the leafhopper and the Formosan leafhopper parasite (*Ootetrastichus* sp.); discusses the control of the Anomala beetle by *Scolia manilae* and the distribution of the Scolia wasp; estimates the Anomala beetle damage; and refers to the cane borer and its tachinid parisite, etc.

[Report of work with insects], H. P. AGEE (*Hawaii. Sugar Planters' Assoc. Rpt. Expt. Sta. Com., 1920, pp. 6–12*).—This reports upon the occurrence of and work with the sugar cane leafhopper; a new natural enemy of the leafhopper, viz, *Drypta australis*; a small bug from Australia which sucks the eggs and their contents, viz, *Cyrtorhinus mundulus;* the relation of Cyrtorhinus to Paranagrus; a brief reference to a small colony of *Antonina australis*, a scale which lives on nut grass; the Anomala beetle and its parasite *Scolia manilae;* a wireworm, *Monocrepidius exul*, which attacks sugar cane; and Australian aphis enemies, viz, *Coccinella arcuata* and the lacewing fly, *Micromus vinaceus*.

[Report of] plant pests control division (*Philippine Bur. Agr. Ann. Rpt., 19 (1919), pp. 49–54, pls. 6*.—Included in this report are accounts of locust and rat campaigns, injury by the abaca weevil, and notes on miscellaneous pests.

Report upon the occurrence of animal enemies and diseases of cultivated plants in the Rhine Province in 1915, E. SCHAFFNIT and G. LÜSTNER (*Veröffentl. Landw. Kammer Rheinprov., No. 4 (1916), pp. 67*).—This report includes accounts of the occurrence of the more important insect and other animal enemies of crops in the Rhine Province in 1915 (E. S. R., 35, p. 243).

Some insects injurious to alfalfa in Virginia, R. R. REPPERT (*Va. State Crop Pest Comn. Quart. Bul., 2 (1921), No. 4, pp. 16, figs. 4*).—This is an account of the more important insect enemies of alfalfa in Virginia based upon studies made during the summers of 1918 and 1919, when alfalfa fields in 23 different counties were investigated.

Insects inhabiting the gum fluid of Phormium, D. MILLER (*New Zeal. Jour. Agr., 21 (1920), No. 6, pp. 335–337, figs. 7*).—The larvae of a number of insects are reported as living in the gum fluid secreted by and collected in the leaf bases of the native flax, *Phormium tenax*, including three dipterous species (*Lepidomyia decessum, Syrphus ropalus*, and a midge of the family Chironomidae).

The correct names of some tobacco pests, H. JENSEN (*Proefsta. Vorstenland. Tabak [Dutch East Indies], Meded. 35 (1918), pp. 17, pls. 4*).—*Gnorimoschema heliopa* Low, *Phthorimaea operculella* Zell., *Chloridea* (*Heliothis*) *assulta* Guen., and *Gonocephalum* (*Opatrum*) sp. are considered, references to the literature being given for the first three.

Insect pests of truck and garden crops, A. L. LOVETT (*Oreg. Agr. Col. Ext. Bul. 325 (1921), pp. 24, figs. 11*).—This is a popular summary of information.

Principal insects and plant diseases attacking the stems of currants and gooseberry plants, H. C. SEVERIN (*S. Dak. State Hort. Soc. Ann. Rpt., 17 (1920), pp. 185–206, figs. 11*).—This has been noted from another source (E. S. R., 42, p. 748).

[Work with cranberry insects], H. J. FRANKLIN (*Cape Cod Cranberry Growers' Assoc. Ann. Rpt., 32 (1919–20), pp. 14–18*).—The spanworm (*Epelis truncataria faxonii* Minot) and the gipsy moth are each said to have been more injurious than has been previously recorded. The fruit worm (*Mineola vaccinii* Riley) and the blackhead fireworm, however, caused less injury than in any year on record.

Injurious insects of the avocado in Florida, G. F. MOZNETTE (*Calif. Citrogr., 6 (1921), No. 5, pp. 152, 184, 185, figs. 8*).—This is a brief summary of

information on the subject, papers relating to which have been previously noted (E. S. R., 43, pp. 53, 255, 851; 44, p. 353).

Insect enemies of the date palm, P. POPENOE (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 9, pp. 382–384*).—This is a brief account of insect enemies of the date palm in Mesopotamia. These include the fig moth (*Ephestia cautella* Walk.), the Indian meal moth, a spider mite, a scale insect thought to be *Parlatoria blanchardi*, and a boring beetle thought to be *Rhyncophorus ferrugineus*.

Protection of cereals and leguminous seeds from insect infestation, P. VIEIRA SOUTO (*Conservação e Immunisação dos Cereaes e Grãos Leguminosos. Rio de Janeiro: Min. Agr., Indus. e Com., Deleg. Exec. Prod. Nac., 1919, 4. ed., pp. 47, figs. 6*).—This is a popular summary of information.

Control of insects injurious to stored grain and seeds, W. P. FLINT (*Ill. Agr. Col. Ext. Circ. 40 (1921), pp. 4*).—This is a popular account.

Insect enemies of sheep and goats, F. C. BISHOPP (*Sheep and Goat Raisers' Mag., 1 (1920), No. 3, pp. 3–8, figs. 6*).—This is a brief popular account.

Household insects and their control, G. W. HERRICK (*Cornell Reading Course for the Home, No. 134 (1920), pp. 46, figs. 25*).—This is a popular account.

Insects and human welfare, C. T. BRUES (*Cambridge: Harvard Univ. Press, 1920, pp. XII+104, figs. 43*).—This is a popular discussion of the more important relations of insects to the health of man, to agriculture, and to forestry.

Dusts and dusting for insect and fungus control, I, G. E. SANDERS and A. KELSALL (*Sci. Agr., 1 (1921), No. 1, pp. 14–18, figs. 2*).—The first part of this paper, which is here presented, deals with the present status of dusting under apple orchard conditions. It is concluded that dusting has several definite advantages over spraying, is as efficient as spraying in the control of scab and of biting insects, and is as cheap or can be made as cheap as spraying, but is inferior to spraying in the control of sucking insects.

Report of dusting and spraying investigations, E. N. CORY (*Md. Agr. Soc. Rpt., 5 (1920), pp. 318, 327*).—In dusting experiments conducted in an orchard badly infested with terrapin scale, three applications of 60 per cent sulphur and 40 per cent lime gave a mortality of 94.2 per cent, thus indicating that nicotin is an unnecessary ingredient.

Experiments show that dusting of strawberries with 85 per cent sulphur and 15 per cent arsenate of lead will measurably increase the crop, a grower at Marion having secured 110 crates per acre on the dusted plats as against 20 crates per acre on the check.

Experimental dusting of tomatoes, beans, and peas for the control of plant lice by use of Niagara Contact Special, a dust composed of sulphur impregnated with 2 per cent nicotin sulphate, with approximately 30 per cent inert ingredients, gave variable results.

Formosan termites and methods of preventing their damage, M. OSHIMA (*Hawaii. Forester and Agr., 17 (1920), Nos. 11, pp. 314–321; 12, pp. 346–355*).—This has been noted from another source (E. S. R., 42, p. 851).

The earwig (Forficula auricularia) as a pest on pear tree leaves in Switzerland, W. STAUB (*Schweiz. Obst u. Gartenbau-Ztg., No. 20 (1919), pp. 313, 314, figs. 2; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 11 (1920), No. 1, pp. 148, 149*).—The author records injury by *F. auricularia* to a pear tree growing in a garden near Bern. One part had only the skeletons and ribs of its leaves remaining, and many of the other leaves were more or less riddled with holes and nibbled round their edges.

Combat potato leafhopper with Bordeaux, J. E. DUDLEY, JR., and H. F. WILSON (*Wisconsin Sta. Bul. 334 (1921), pp. 32, figs. 18*).—This bulletin is based

upon work by the Bureau of Entomology of the U. S. Department of Agriculture in cooperation with the Wisconsin Experiment Station. The work, a brief account of which by Dudley has been previously noted (E. S. R., 44, p. 549), has shown that Bordeaux mixture will repel the leafhopper and hold hopperburn down to a point where it causes no appreciable loss.

In experiments conducted in 1919 Bordeaux mixture repelled the pest, but neither nicotin sulphate nor kerosene emulsion gave satisfactory control. In experiments in 1920 on a large plat of ground planted to five varieties, namely, Early Triumph, Early Ohio, Irish Cobbler, Green Mountain, and Rural New Yorker, Bordeaux mixture (4:4:50) again proved effective, four applications having been made. It is recommended that at least three applications of the spray be made and an additional application if leafhoppers or hopperburn persist. Of the several varieties tested, Early Triumphs were always affected worst and Rural New Yorker always least. Early potatoes generally should be more closely watched than late ones.

Address on the control of the mosquito blight of tea, E. A. ANDREWS (*Indian Tea Assoc., Sci. Dept. Quart. Jour., No. 3 (1920), pp. 67–82, pls. 2; also in Trop. Agr. [Ceylon], 56 (1921), No. 1, pp. 31–40*).—This account includes a diagrammatic representation of the life history of *Helopeltis theivora* Waterh.

Crop rotations to starve the chinch bugs, W. P. FLINT and W. L. BURLISON (*Ill. Agr. Col. Ext. Circ. 39 (1920), pp. 4, fig. 1*).—This is a brief popular account.

The green bug or spring grain aphis: How to prevent its periodical outbreaks, W. R. WALTON (*U. S. Dept. Agr., Farmers' Bul. 1217 (1921), pp. 11, figs. 9*).—This is a popular summary of information.

The dictyospermum scale on the avocado, and how it may be controlled, G. F. MOZNETTE (*Fla. Plant Bd. Quart. Bul., 5 (1920), No. 1, pp. 5–11, figs. 5*).—A brief account is given of *Chrysomphalus dictyospermi* Morg., which has been found by the author to be especially injurious to the avocado in sections of Florida where the temperature is quite even and in the more protected places, such as groves situated on the keys and stretches of land lying between the ocean and bay inlets along the east and west coasts. The pest is, however, often present in groves on the mainland, and is to be found in varying numbers in nearly every place where the avocado is grown in southern Florida. It is a pest in avocado nurseries, and especially finds protection where the trees are crowded together in rows and blocks. Both the West Indian and Guatemalan varieties in the nurseries are infested by it. Its life history and habits are briefly considered. *Aspidiotiphagus citrinus* Craw., a parasite of it, is of economic importance.

Control experiments have shown two applications of oil emulsion to be the most satisfactory and efficient. These should be applied while the trees are dormant, usually from the middle of December until the first of February, at the rate of 1 gal. of emulsion to 70 gal. of water.

The European elm scale (Gossyparia spuria Modeer), G. M. LIST (*Colo. State Ent. Circ. 29 (1920), pp. 12, figs. 17*).—This is a popular summary of information on the European elm scale, which is rather limited and well defined in its distribution in Colorado. It has been known to be in the city of Denver for 8 to 10 years, but has not been generally distributed or abundant enough to do serious damage until the last 2 or 3 years. It is now becoming quite general over the entire city. Specimens have recently been received from Golden, and there is known to be an infestation near Fruita, Mesa Co.

On the probable identity of Rickettsia pediculi with R. quintana, A. BACOT (*Brit. Med. Jour., No. 3135 (1921), pp. 156, 157, fig. 1*).—The data presented indicate that *R. pediculi*, supposed to represent bodies in lice taken from

healthy persons, and *R. quintana*, found associated with lice that have fed on trench fever patients, represent the same form.

"Trench fever patients may remain capable of infecting lice with *R. quintana* for at least three months after the cessation of febrile attacks or other obvious symptoms. Persons in apparently good health may therefore infect lice with *R. quintana*. Lice infected with Rickettsia bodies indistinguishable from *R. quintana* were present in Warsaw in 1920, and were associated there with a case of trench fever."

Pebrine in India, C. M. HUTCHINSON (*India Dept. Agr. Mem., Bact. Ser., 1 (1920), No. 7, pp. VII+177–245, pls. 26*).—This is a detailed report of investigations of *Nosema bombycis*.

Investigations of the outbreak of the nonne in Gualöv, I. TRÄGÅRDH (*Meddel. Statens Skogsförsöksanst., No. 17 (1920), pt. 4, pp. 301–328, figs. 8*).—This is a report of studies made during an outbreak of the nun moth (*Lymantria monacha* L.) in Sweden from 1915 to 1917. An account of the occurrence of its parasites is included.

Treatment of cotton in the field as a combative measure against Gelechia attacks, W. CARTWRIGHT (*Agr. Jour. Egypt, 9 (1919), pp. 126–128*).—The results obtained support previous experience (E. S. R., 42, p. 548) and shows that reducing the amount of water in July and stopping all water after approximately the first week in August increases the yield and makes the crop ripen earlier.

Combating the pink bollworm in Brazil (*Bol. Min. Agr., Indus. e Com. [Brazil], 8 (1919), No. 2, pp. 93–102; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 7, p. 290*).—It is reported that a loss of 70 per cent was caused by the pink bollworm in one locality in the State of Maranhao. In the State of Piauhy carbon bisulphid and hot water are used for seed disinfection. In that State the cotton leaf worm and a weevil (*Gasterocercodes gossypii* Pierce) also injure the crop.

On the effects produced by the attacks of the pink bollworm on the yield of cotton seed and lint in Egypt, L. H. GOUGH (*Agr. Jour. Egypt, 9 (1919), pp. 50–107, pls. 4*).—This is a detailed report of investigations conducted, mainly presented in tabular form. Graphs are given which show the fluctuations of the atmospheric humidity and the simultaneous fluctuations in weight of cotton seed and lint. A bibliography of six pages is included.

The maize stalk borer (Busseola fusca Fuller), C. W. MALLY (*Union So. Africa, Dept. Agr. Bul. 3 (1920), pp. II+111, pls. 5, figs. 31*).—This is a report of studies of an African insect which has adapted itself to corn in South Africa, where corn is the most important cultivated crop.

The codling moth in the Payette Valley, L. E. LONGLEY (*Idaho Sta. Bul. 124 (1921), pp. 27, figs. 10*).—This is a report of work conducted during 1920 by the Idaho Experiment Station in cooperation with the University of Idaho Extension Division and the Payette County Farm Bureau. Observation covered points extending from Valley View section, east of New Plymouth, through Payette and Snake River Valleys, almost to Weiser.

The time of emergence of the first brood was greatly prolonged by the abnormally low temperatures during late May, emergence extending from May 18 to nearly the middle of July. This necessitated two sprays for the first brood and two sprays for the second brood in addition to the calyx spray. "There was found to be a variation of as much as a week in the spray dates for different localities in the valley, depending on the type of soil and the lay of the ground. There was a variation in spray dates for different orchards dependent on the type of culture given. In general, anything growing near the tree trunk

tended to delay and prolong the transformation of the moth. No appreciable destruction of the over-wintering larvae by the cold winter temperatures was apparent. Birds, ants, and spiders were observed to have destroyed a small percentage of over-wintering larvae. There was an overlapping of the first and second broods brought about by the prolongation of the first brood. The bulk of the eggs of the first brood of moths were found to be deposited on the fruit itself, only about 20 per cent being located on leaves.

"The data collected indicated that the calyx spray is important in the control of the insect, but does not have all the value that has been credited to it. From the observations and experiments it is evident that five sprays are advisable in a season like 1920 in the Payette Valley; one calyx spray, two sprays for the first brood, and two sprays for the second brood. The observations indicate that in certain years the spraying fails to adequately control the codling moth for the following reasons: (1) In years of very short crops little or no spraying is conducted, and the number of wintering-over larvae increase greatly, causing a heavy infestation the following season; (2) in many sections there are not enough spray outfits to aequately spray the orchards on time; (3) there is much careless spraying; not enough liquid is applied to cover all sides of the fruit with poison; and (4) many growers have not been putting the poison on the trees at the times when it would do the most good; that is, they have not kept informed of the stages of the codling moth and have applied the spray in a hit and miss manner; if they had known how the insect was developing the spray would have been more effective."

The use of hydrocyanic acid gas against vine moths, F. Stellwaag (*Verhandl. Deut. Gesell. Angew. Ent., 2 (1918), pp. 24–34; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 10, p. 427*).—The treatment of vineyards with solutions of hydrocyanic acid in water has given very promising results, vine moth pupae being killed by gas from a solution as weak as 0.5 per cent.

On the occurrence of Aedes sollicitans in fresh water polluted by acid waste, S. F. Hildebrand (*Science, n. ser., 53 (1921), No. 1364, p. 163*).—The author records the occurrence of the salt-marsh mosquito *A. sollicitans* in fresh water polluted by acid waste from a fertilizer factory at Savanah, Ga. The acid content of a sample of water taken farther down the stream, where the pollution had become greatly diluted, was found to be 2.08 per cent of free acid, with a large amount of iron.

Literature on the relation of Anopheles to malaria, E. Martini (*Hyg. Rundschau, 30 (1920), No. 24, pp. 737–742*).—One hundred and eight titles are listed.

One or several species of malaria parasites? B. Mayne (*Pub. Health Rpts. [U. S.], 35 (1920), No. 48, pp. 2846–2858*).—A review of recent work bearing on this question.

Seasonal abundance of the mosquito-destroying top minnow, Gambusia affinis, especially in relation to male frequency, R. L. Barney and B. J. Anson (*Ecology, 2 (1921), No. 1, pp. 53–69, figs. 5*).—This is a contribution from the U. S. Bureau of Fisheries.

The rôle of live stock in malaria prophylaxis, E. Roubaud (*Pub. Health Rpts. [U. S.], 35 (1920), No. 42, pp. 2464, 2465*).—This relates to the account noted from another source (E. S. R., 43, p. 853).

Distinguishing characters of the larval stages of the ox-warbles Hypoderma bovis and H. lineatum, with description of a new larval stage, E. W. Laake (*Jour. Agr. Research [U. S.], 21 (1921), No. 7, pp. 439–457, figs. 24*).—This is a report of studies conducted by the Bureau of Entomology, U. S. Department of Agriculture, with a view to determining the value of the posterior

stigmal plates and other characters for differentiating the four larval stages previously known and to describe a new larval stage of *H. lineatum* De V.

The studies have shown that very reliable characters exist for distinguishing the larvae of these two species, separation in the last two stages, the fourth and fifth, having been found to be easy by a comparison of the form and structure of the posterior stigmal plates. The character of the spiny armature, first described by Brauer, which has been entirely relied upon by all investigators up to the present time for the distinguishing of the species, is good only for the last or fifth larval instar; while the characters of the stigmal plates permit, with absolute certainty, the differentiation of the fourth as well as the fifth larval instar. Although stigmal plates vary greatly in the different stages of development and to a considerable extent in the same stage, and there may even be a marked variation between the two spiracles on the same specimen, yet there are always certain definite associated characters which can be relied upon for each species.

During the course of his studies the author discovered a new or second larval stage, which was found in the esophagus of the host. This new stage is unlike the small, heavily armed larva that hatches from the egg, or the larger, spineless larva that is later found in the esophagus or on the back before molting to the next spiny stage. It is pointed out that there is a possibility of the occurrence of other intermediate stages, especially between the first stage and the first one found in the esophagus. The third or unarmed stage that reaches the back molts from the smaller or armed second stage before it leaves the esophagus, or possibly, in some instances at least, on its journey to the back. Many specimens from gullets, as long as 14 mm., are still in the second stage, while others similarly located and measuring as low as 11 mm. are in the third stage.

The details are given of studies of the differentiation of *H. lineatus* and *H. bovis* in the fifth, fourth, and third instars. There is also a description of the second instar of *H. lineatum* and distinguishing characters in first instar larvae of both species.

Experiments on the carriage of intestinal protozoa of man by flies, F. M. Root (*Amer. Jour. Hyg., 1 (1921), No. 2, pp. 131–153, pls. 3*).—"Free forms of *Entamoeba histolytica* and *Chilomastix mesnili* ingested by flies were killed in an hour or less, not encysting. Motile Chilomastix were observed in a fly's feces seven minutes after it had fed on a stool containing them. Cysts of the intestinal protozoa ingested by flies were gradually killed in times varying with the species. . . . When flies which had ingested cysts were drowned in water, the cysts survived much longer. . . .

"In experiments designed to test the maximum capacity of flies at a single meal, it was found that a single house fly could ingest 0.0068 cc. of fluid and a single blow fly (*Calliphora erythrocephala*) could ingest 0.022 cc. An infection with *Herpetomonas muscae-domesticae* was found in only one out of 225 specimens of *Musca domestica* examined at Baltimore. Two infections with *H. calliphorae* were found in 124 specimens of *C. erythocephala* examined."

Notes on a cestode occurring in the haemocoele of house flies in Mesopotamia, J. H. Woodger (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 345–351, figs. 3*).—Dissections of house flies undertaken at Amara, Mesopotamia, led to the detection of a cestode parasite in the abdominal haemocoele. The total number of infected flies found was 5 out of 338 dissected in the locality. A description is given of the parasite, preliminary feeding experiments are recorded, and the literature relating to the parasitism of the house fly by cestodes is reviewed.

One year's experiments in the control of the cabbage maggot, W. H. BRITTAIN (*Ent. Soc. Ontario Ann. Rpt., 50 (1919), pp. 61–68*).—This is a report of experiments conducted in 1919 in continuation of work initiated in 1917 (E. S. R., 43, p. 850).

Some of the treatments were entirely inadequate to control the maggot. A few showed a decided advantage over the check plats, but not sufficient to make them worthy of further trial, namely, nicotin sulphate and clay, nicotin and sulphur, paradichlorobenzene alone, and salt solution in the strength tested. Others actually appear to have weakened the plants to such an extent that a greater number succumbed to the attacks of the maggot than on the check rows, namely, dry lime sulphur, white arsenic, arsenate of soda, and combinations of these compounds.

An examination of other treatments showed that the plat treated with tobacco dust, corrosive sublimate, and clay mixture gave the smallest number of plants actually destroyed, with the creosote plat a close second, having only one more casualty and the largest tonnage per acre of any plat, as well as a lower cost of treatment and greater profit per acre. The plat treated with anthracene oil was only slightly behind the creosote plat in the number of marketable heads produced, but it fell below the paradichlorobenzene and soot plat in tonnage per acre, which, however, was probably due to another reason than maggot control. The plat treated with tobacco dust, white arsenic, and clay was apparently next in efficiency, but this plat also fell below the paradichlorobenzene and soot plat in tonnage per acre, and even the paradichlorobenzene and clay plat, which lost three times as many plants but produced a greater weight of head. The paradichlorobenzene and soot plat came second in tonnage per acre produced; the plants in this plat were noticeably benefited by the treatment, having a deeper green color of leaf and a healthier general appearance than the other plats.

The control of the cabbage root maggot in British Columbia, R. C. TREHERNE and M. H. RUHMANN (*Ent. Soc. Ontario Ann. Rpt., 50 (1919), pp. 68–70*).—The corrosive sublimate treatment for the control of the cabbage root maggot was tested during 1919 in comparison with the tar-paper-disk method. On untreated blocks of cauliflowers 76.5 per cent of the plants were injured by maggots. Where the tar paper disks were used the maggot infestation was 25.3 per cent, while in the case of three applications of corrosive sublimate (May 7, 13, and 28), infestation was reduced to 1.8 per cent.

Observations on the life history of the wheat-bulb fly (Leptohylemyia coarctata Fall.), F. R. PETHERBRIDGE (*Jour. Agr. Sci. [England], 11 (1921), No. 1, pp. 99–105, pls. 2*).—The author finds that *L. coarctata* has but a single generation each year in England, although Comte records two generations on wheat in Tunis[1] and Wahl records two generations in Germany but only one in Denmark (E. S. R., 32, p. 350). Experiments and observations on the life history of this species are summarized as follows:

"The flies hatch out in June and July and lay their eggs in bare soil about ⅛ in. below the surface in July, August, and possibly September. Most of these eggs hatch out early in the following spring, as they are usually found in the wheat plants in March and April. A few may, however, hatch out the same autumn, as on November 23, 1917, I found two third-stage larva attacking wheat plants on the university farm. On February 13, 1920, I found a second-stage larva attacking wheat on the university farm.

"The larva on hatching from the egg makes its way into the middle of a wheat shoot, where it feeds at the base of the shoot which it kills. Wahl has

[1] Parasites du Blé. Rev. Agr. et Vit. Afrique Nord, 3 (1914), Nos. 96, 97.

shown that the larva may attack several plants in succession. When fully fed, the third-stage larva make their way into the soil, where they pupate about 1½ to 2 in. below the surface. Pupation usually takes place in May.

"This habit of egg laying in bare soil in the case of a specific pest seems to be unique and may possibly be due to a change of diet. It will be interesting to find out what happens when crops other than cereals are sown in soil containing their eggs."

Leishmania, Herpetomonas, and Crithidia in fleas, C. BASILE (*Parasitology, 12 (1920), No. 4, pp. 366–377, pls. 2*).—An account based upon investigations by the author.

The response of Popillia japonica to light and the Weber-Fechner law, A. R. MOORE and W. H. COLE (*Jour. Gen. Physiol., 3 (1921), No. 3, pp. 331–335, fig. 1*).—Investigations with the Japanese beetle led to the conclusions that light and a temperature above 23° C. (73.4 F.) are necessary for the activity of Popillia. The effect of light as indicated by the rate of locomotor response is related to light intensity according to Fechner's expression of Weber's law.

The rhinoceros beetle (Oryctes rhinoceros L.), S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 41 (1920), pp. VIII+156, pls. 19*).—This is an extended report of studies of *O. rhinoceros* in the Dutch East Indies, which includes a 10-page summary in English.

Sugar-cane beetles, C. MOREIRA (*Bol. Min. Agr., Indus. e Com. [Brazil], 8 (1919), No. 2, pp. 103–119, pls. 13; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 7, pp. 290–292*).—In the State of Pernambuco, where most of the Brazilian sugar is produced, severe loss has been caused by sugar-cane beetles, particularly *Ligyrus fossator* Dej. and *Podalgus humilis* Burm.

The fig and willow borer (Phryneta spinator), D. GUNN (*Union So. Africa, Dept. Agr. Bul. 6 (1919), pp. 22, figs. 16*).—This borer is said to have been known for many years in South Africa and to be distributed throughout the Union. In many localities it seriously affects profitable growth of figs year after year.

"Its principal food plants are willow and fig, but it also sometimes injures other trees, such as apple, peach, pear, plum, and grapevines. The eggs are deposited in slits cut in the bark of fig and willow trees. When the larvae emerge they feed at first upon the tissue surrounding the egg slits; afterwards they burrow into the wood, where they remain for about two and a half years. The full life cycle of specimens under observation from the egg to the adult stage occupied a period of slightly over three years." Destruction of the borers by use of a knife or strong flexible wire or the injection of paraffin or carbon bisulphid into the burrow and the application of fine wire netting is advised.

The tobacco slug (Lema bilineata Germar), C. P. VAN DER MERWE (*Union So. Africa, Dept. Agr. Jour., 2 (1921), No. 1, pp. 28–38, figs. 3*).—This is a report of studies of the biology and control of a beetle the larva of which is a source of injury to tobacco through feeding on the leaves. If many larvae are present on a leaf, in a short time only the midrib and a few large side ribs will be left. The damage done by larvae brought into the sheds on the plants when harvested is very great.

Studies of flea-beetles, N. A. KEMNER (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 185 (1919), pp. 17, figs. 12*).—The author's first contribution to the knowledge of flea-beetles deals with *Haltica oleracea* L., its life history, habits, and economic importance in Sweden. The paper includes a list of 23 references to the literature.

Utilization of coccinellids for the control of insect pests in the south of France, P. MARCHAL (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 2, pp.*

105-107).—The author reports upon the introduction of *Cryptolaemus montrouzieri* Muls. into France from California in 1918 and 1919, the rearing of it at Menton, and its establishment in the open. It is becoming acclimated to the Mediterranean littoral, and bids fair to play an important part in mealy bug control.

The coffee-berry borer (Stephanoderes hampei Ferr. [coffeae Hgd.]) in the Dutch East Indies, W. Roepke (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 38 (1919), pp. 32, pls. 3*).—A report of studies of this enemy of the coffee berry, with a list of 14 references to the literature.

Banana root borer (Cosmopolites sordidus Germar), T. McCarthy (*Agr. Gaz. N. S. Wales, 31 (1920), No. 12, pp. 865–872, pls. 2, fig. 1*).—This account of *C. sordidus* deals with the character of its injury, describes and illustrates its life history and habits, discusses its seasonal history, and gives a brief account of precautionary and control measures and of its natural enemies.

Apiculture in South Africa, A. J. Attridge (*So. African Jour. Indus., 3 (1920), No. 11, pp. 993–1000, figs. 9*).—This deals with the present position and prospects of apiculture in South Africa.

Swarm control, G. S. Demuth (*U. S. Dept. Agr., Farmers' Bul. 1198 (1921), pp. 47, figs. 13*).—This account includes a discussion of the factors influencing a tendency to swarm, natural swarming, treatment to anticipate swarming, etc. The more important preventive measures are considered at some length.

The normal bacterial flora of the bee, P. B. White (*Jour. Path. and Bact., 24 (1921), No. 1, pp. 64–78, pls. 2*).—"The intestine of the adult bee possesses a distinct fundamental flora of considerable constancy and relative simplicity. Further, the organisms are as a whole characterized by their predilection for glucose-containing media, and the fermentation of this sugar without gas production. Further, the majority are either anaerobic or thrive best under reduced oxygen conditions. The organism to which the name *Bacillus constellatus* has been given is probably closely related to *B. bifidus communis* of the breast-fed infant. It probably corresponds to the "Bacterium D" of White [E. S. R., 18, p. 561], though he states that there is no fermentative action on glucose.

"Whether the organism which has been referred to as *Streptococcus apis* (var.?) in this paper is really the variety of *S. apis* (Maassen) isolated from foul-brood larvæ is doubtful. According to White [E. S. R., 43, p. 58] this organism is usually diplococcoid, but may occasionally form chains of two or more pairs. Growth occurs on gelatin at refrigerator temperature and liquefaction sets in. Mannite is fermented. The streptococcus of the adult bee differs in forming chains of great or considerable length and in not fermenting mannite. Attempts to obtain growth on gelatin at 22° C. have failed."

A contribution to the life history of the Argentine ant, M. C. Grabham (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 87 (1919), p. 209*).—This is an abstract of a paper in which the author describes the insidious introduction of this ant into Madeira, its spread, and the complete suppression of competing species. It is said to be established in destructive colonies in that island up to 2,500 ft. above sea level. Coffee cultivation has been ruined, and every sort of fruit tree, citrus especially, which will support coccus or aphis almost entirely destroyed. Sugar cane and bananas still exist, though badly attacked, while sweet potatoes have disappeared in many districts. Every house is said to be invaded by the pest, and poultry, young birds, and bees are attacked by it.

Growing the new black scale parasite, H. M. Armitage (*Calif. Citrogr., 6 (1921), No. 5, p. 143, figs. 4*).—A brief outline is given of the methods used by the California State Department of Agriculture in the rearing, at the laboratory

at Alhambra, of *Aphycus lounsburyi*, the newly introduced South African black scale parasite.

Control of red mite on apple trees, G. STRATFORD (*New Zeal. Jour. Agr., 20 (1920), No. 3, pp. 176–178*).—In control work with oil sprays, all the brands of red oil used were very successful in the destruction of the winter eggs, and very few hatched. The experiments indicate that a delayed spraying, using the oil at the strength 1:8, as late as possible, will do much to control red mite when in the egg stage. Lime sulphur used at the rates 1:6 and 1:25 appeared to have very little effect upon the eggs, whereas lime-sulphur sprays used at the rates 1:80 and 1:100 at fruit-formation period were more successful, clearing up the newly hatched mite to a remarkable degree.

Spinning mites (family Tetranychidae), W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 32 (1921), No. 2, pp. 130–135, figs. 4*).—Accounts are given of the red spider mite (*Tetranychus telarius* L.) and of the clover, or apple stem, mite.

FOODS—HUMAN NUTRITION.

A study of the factors affecting temperature changes in the container during the canning of fruits and vegetables, C. A. MAGOON and C. W. CULPEPPER (*U. S. Dept. Agr. Bul. 956 (1921), pp. 55, figs. 57*).—Following a critical review of the literature on the subject, a report is given of an extensive investigation of the factors influencing temperature changes in the containers (both tin and glass of various sizes) during the single period and intermittent processing of vegetables and also during the subsequent cooling. A special apparatus was devised for measuring the temperature changes at the center of the can by means of a properly calibrated and standardized mercury thermometer. The apparatus, which is described and illustrated, is suitable for use either with the commercial tin can or with the glass jars of the Mason screw-top type, and is said to be easily constructed and operated and to be sufficiently accurate for all practical purposes.

Preliminary experiments to serve as a basis for comparison indicated that the general factors affecting the rate of change of temperature at the center of the can are the diameter of the container, the conductivity, thickness, and radiative power of its walls, the temperature, conductivity, and mobility of its contents, and the temperature, conductivity, and movement of the medium surrounding it.

The materials used in the single processing tests were string beans, peas, lima beans, soy beans, asparagus, sweet corn, pumpkins, sweet potatoes, tomatoes, and cabbage, and in the intermittent processing string beans, sweet corn, soy beans, and sweet potatoes. These materials were found to fall roughly into two groups with reference to time-temperature relations, the first consisting of those vegetables such as string beans, tomatoes, etc., so packed that there is a free liquid filling the spaces between the pieces of material, and the second those materials such as corn, pumpkin, etc., so packed that little or no convection can occur. In the former the rate of change of temperature was very rapid and in the latter very slow unless mechanical agitation was employed. Variations in the composition of the material had very little effect if the consistency was such that no convection could occur. The glass container was found to have a marked retarding effect upon the rate of rise in temperature in materials of the first group, but to be of little importance in the second group. Differences in the diameter of the container were of much less importance in materials of the first than those of the second group. In materials of the first group cooling was very rapid, but was considerably slower in materials of the second group. Cooling in air was always much slower than cooling in water.

The addition of sodium chlorid or of dilute sugar solutions had very little effect upon the rate of change of temperature in the can, but concentrated sugar solutions and starch solutions had a marked retarding effect, increasing rapidly with the concentration. Other viscous material, such as protein or pectin, was also found to retard the rate of change of temperature.

In the intermittent process any change during the first processing period which interfered with convection was found to retard the rate of change of temperature during the second processing period. If the material at the beginning was such that no convection occurred, the first processing period had little or no effect upon the rate of change of temperature during the second period.

The chemical composition of natural and polished Italian rice, G. Issoglio (*Atti R. Accad. Sci. Torino, 53 (1918), No. 12, pp. 731–744*).—Analyses are reported of several varieties of Italian rice, the data given including in addition to proximate analyses determinations of total phosphorus, lecithin, and phytic phosphoric acid, total ash, and ash soluble and insoluble in 10 per cent HCl. It is pointed out that the polished rice is much poorer in both inorganic and organic phosphorus compounds than the natural rice.

Hypochlorite process of oyster purification.—Report on experimental purification of polluted oysters, on a commercial scale, by floating them in sea water treated with hypochlorite of calcium, F. A. Carmelia (*Pub. Health Rpts. [U. S.], 36 (1921), No. 16, pp. 876–883*).—The method previously suggested by Wells (E. S. R., 35, p. 763) as a feasible process for purifying polluted oysters has been tested on a commercial scale at Great Kills Harbor on Raritan Bay, New Jersey.

The oysters, in 60 to 150 bu. quantities, are floated in sea water containing sufficient calcium hypochlorite to give from 4 to 6 parts per million of free chlorin. After 6 hours a second treatment of the water with hypochlorite is made, and the oysters are allowed to remain undisturbed for an additional period of from 12 to 18 hours, when they are ready to be removed and marketed. The bacteriological results of this treatment in the case of oysters of an original *Bacillus coli* score of 50 or more showed an average reduction of 90 per cent of the *B. coli* count. It is believed that oysters with an original score of from 230 to 320 represent about the maximum pollution which can be safely reduced to an acceptable score. The application of this process on a small or large scale is considered entirely feasible and desirable if properly supervised.

Metabolism and growth from birth to puberty, F. G. Benedict and F. B. Talbot (*Carnegie Inst. Wash. Pub. 302 (1921), pp. VI+213, pl. 1, figs. 53*).—This monograph reports in detail the results of the investigation of the basal metabolism of children from birth to puberty which have been briefly summarized in previous papers by Talbot (E. S. R., 42, p. 168) and Benedict (E. S. R., 43, p. 166). The present report and two previous monographs from this laboratory (E. S. R., 32, p. 461; 34, p. 861) give a complete summary of the results obtained in the whole research on the metabolism of children during this period, together with a comprehensive and critical discussion of the data presented in the literature on the metabolism of children.

From the data obtained in this investigation the authors have attempted to establish a prediction for normal metabolism for boys and girls. The plotted curves for total calories per 24 hours, referred to weight, when compared with the essential physical data for the individual children, gave for body weights of less than 10 kg. an error for the boys in the prediction of metabolism of ±8.7 per cent and for the girls ±11.8 per cent. Above 10 kg. the error in prediction was ±6.3 per cent for the boys and ±7.5 per cent for the girls, while

for 15 kg. or above the respective errors were ±5.8 and ±6.1 per cent. The predicted heat from total calories, referred to surface, when compared with actual data showed with a surface area below 0.45 sq. m. an error prediction of ±7.7 per cent for boys and ±11.6 per cent for girls. With surface areas between 0.5 and 0.65 sq. m. the errors in prediction were, respectively, ±7.3 and ±8.5 per cent, and for surface areas of 0.65 or above ±6.8 and ±6.8 per cent. The prediction of the metabolism of boys by the multiple prediction formula of Harris and Benedict (E. S. R., 41, p. 760) gave a prediction error of ±6.3 per cent, the same as for body weight.

The authors conclude that "if due cognizance is taken of the probable deviations from the general trend, the curves for total calories referred to body weight and total calories referred to body surface may be considered as distinctly helpful in indicating whether or not there is great diversity from the general trend with children having any particular configuration or any particular illness, or subsisting upon any dietetic régime or nutritional plane, or with any physiological change affecting the group."

To assist clinicians a table has been prepared giving the most probable heat production for each 500 gm. of body weight for both boys and girls, thus enabling a rapid comparison of actual and probable heat production.

Nutrition in Vienna: A study of the food supply and state of nutrition of the working classes in Vienna, M. R. GRIBBON and M. I. H. FERGUSON (*Lancet [London], 1921, I, No. 10, pp. 474–476*).—The authors report briefly the results of a detailed study of the diets of 49 families of the poorer classes in Vienna, including 49 men, 65 women, and 139 children under 14 years. In determining the energy value of the food eaten Atwater's analyses were generally used and for the man value of the families Lusk's coefficients. With these coefficients the average dietary yield per man per day of the 49 families was energy 2,064 calories, total protein 64 gm., protein from animal sources 5.3 gm., and fat 40.2 gm. The available energy was calculated as about 1,860 calories. Most of the dietaries included a small amount, about 125 gm. per week, of meat in the form of pork, horse meat, or sausage. Only 2 of the families had fresh milk, and the fat was generally in the form of margarins.

The data are classified in two groups, one of 29 families in which rickets were present, and the other of 20 families without rickets. The energy value of the diet of the families with rickets was 440 calories per man per day below that of those without it, the protein intake 13.2 gm. less, and the animal protein 3.3 gm. less. The differences were chiefly due to a greater shortage of flour, bread, and vegetables, with but little difference in the average amount of fat. Height and weight measurements of the children showed that the insufficient diet was associated with marked deficiency in growth, the deficiency in weight being more marked than in height.

Vitamins essential food factors, B. HARROW (*New York: E. P. Dutton & Co., 1921, pp. XI+219, figs. 8*).—About two-fifths of this volume consists of an elementary treatment of the functions of the hitherto recognized constituents of the diet. About the same amount of space is devoted to vitamins, which are sketched in their relationship to plant growth, beriberi, rickets, scurvy, and pellagra. The rest of the volume consists of an appendix, including considerable material from the British committee report on vitamins previously noted (E. S. R., 43, p. 262).

The physiological value of the vitamins, A. D. EMMETT (*Jour. Amer. Pharm. Assoc., 10 (1921), No. 3, pp. 176–182*).—A review and discussion of the literature dealing with the physiological significance of vitamins.

The distribution of accessory food factors (vitamins) in plants, E. M. DELF (*So. African Jour. Sci., 17 (1920), No. 1, pp. 121–125*).—This is a brief

summary of present knowledge concerning the distribution in the plant world of vitamins A, B, and C. It is pointed out that while green cabbage contains both vitamins C and A, the etiolated leaves of the white heart of a cabbage possess antiscorbutic but no growth-promoting properties, thus indicating the probability that the production of A is connected with photosynthesis in the green leaves.

A note on the differentiation of the yellow plant pigments from the fat-soluble vitamin, M. STEPHENSON (*Biochem. Jour., 14 (1920), No. 6, pp. 715–720, fig. 1*).—This is a further contribution to the question of relationship between vitamin A and the yellow plant pigments.

A crude alcohol light petroleum extract of dried carrot, when added to a fat lacking in vitamin A, conferred upon it growth-promoting properties and protected rats from keratomalacia. Pure carotin extracted from carrots was without effect, thus showing that the active substance in the extract was not carotin. Butter from which the coloring matter had been completely removed by filtration through charcoal did not lose its growth-promoting properties.

The author concludes that vitamin A can not be identified with carotin.

The effect of temperature and of H-ion concentration upon the rate of destruction of antiscorbutic vitamin, V. K. LAMER, H. L. CAMPBELL, and H. C. SHERMAN (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 4, pp. 122, 123*).—In this brief report of a study, the details of which are to be presented in a later paper, the authors note that boiling for 1 hour destroyed practically 50 per cent and for 4 hours 70 per cent of the antiscorbutic vitamin present in tomato juice of natural acidity of pH=4.2. On neutralizing partially or entirely the natural acidity of the juice, boiling for an hour, immediately cooling, and reacidifying, it was found that the rate of destruction of the vitamin at 100° C. increased regularly with the extent of neutralization. At pH=5.1 to pH=4.9 the destruction during 1 hour's boiling was increased to 58 per cent, while with an initial H-ion concentration of pH=11, falling to about pH=9 during boiling, the destruction was about 65 per cent. On repeating these experiments with reacidification omitted and storing the juice for 5 days in the ice box, the destruction amounted to 90 or 95 per cent.

"Whether the difference between the juices which were, and those which were not, reacidified is attributable wholly to the prolonged action of the hydroxyl ions at a temperature of 10°, and pH only 9, or whether there are here involved other factors, possibly including a tendency toward reversal of the destructive process upon reacidification, remains to be determined."

The effects of heat and aeration upon the fat-soluble vitamin, F. G. HOPKINS (*Biochem. Jour., 14 (1920), No. 6, pp. 725–733, figs. 5*).—To determine the effect of heating and aeration upon vitamin A, 8 series of feeding experiments were conducted upon young rats so selected that all of the animals of a single series were of the same age, size, and sex, from 8 to 10 rats being used in each series. The animals were all fed a basal ration of purified caseinogen, potato starch, cane sugar, salt mixture, and 15 per cent of filtered butter. Half of the rats in each of 6 sets received butter heated in the autoclave for different lengths of time without aeration and the other half the same butter heated with aeration. In one set the butter was heated at 80° C., and in another was exposed in thin layers for a week at ordinary temperatures.

In all of these experiments growth was normal on the unaerated fat, but cessation of growth resulted with the aerated fat. In 60 per cent of all the animals fed upon butter aerated at 120° for 4 hours or more symptoms of eye trouble developed, but in none of the animals on the unaerated butter. These studies indicate that 4 hours' exposure to 120° in the absence of air does not appreciably affect the vitamin content of butter, at least when fed at 15 per

cent of the food intake; that 12 hours' exposure under the same conditions involves slight destruction; aeration for 4 hours at 120° destroys the greater part of the vitamin, and for 12 hours causes almost complete destruction; aeration at 80° destroys the vitamin quite rapidly, and exposure to air at ordinary temperatures for a week practically destroys the vitamin. Identical figures were obtained for the iodin value of the fatty acids of the butter before and after heating for 4 hours in a stream of air at 120°.

A brief note is also made of experiments conducted to determine whether any destruction of vitamin takes place during the commercial purification of vegetable fats such as palm kernel oil and peanut oil. No difference in vitamin content could be observed between the crude and refined product.

Attention is called in the discussion of the experimental data to the influence of season and of stock upon growth curves. In the opinion of the authors the curve of normal growth of animals varies with both these factors, and hence it is considered advisable to compare growth upon a given dietary with curves obtained at the time of the experiment from comparable animals on a normal dietary rather than with an accepted curve of normal growth.

Researches on the fat-soluble accessory factor (vitamin A).—VI, Effect of heat and oxygen on the nutritive value of butter, J. C. Drummond and K. H. Coward (*Biochem. Jour., 14 (1920), No. 6, pp. 734–739, figs. 3*).—The technique employed in this study was the same as that described in the third paper of this series (E. S. R., 44, p. 764), and thus differed from the method of Hopkins in the above study in that the butter fat was fed in small amounts (0.2 gm.) as a supplement to the daily vitamin A-free basal ration to rats whose growth had been completely inhibited by withholding this vitamin from the diet. The temperatures and time of aeration were as follows: Exposure to a current of live steam for 6 hours, and heating at 96° C. for 15 hours, at 50° for 6 hours, and at 37° for 3 weeks with and without exposure to air.

The results of these studies also indicate that destruction of vitamin A takes place rapidly at high temperatures, and to a considerable extent at temperatures as low as 37° in the presence, but not in the absence, of air.

The action of ozone on the fat-soluble factor in fats, S. S. Zilva (*Biochem. Jour., 14 (1920), No. 6, pp. 740, 741*).—Following the observation that vitamin A in butter fat is inactivated by exposure to ultraviolet rays (E. S. R., 42, p. 59), a further study was made to determine whether this was due to the action of the rays or to ozone produced by the mercury quartz lamp. Cod liver oil exposed for 16 hours in thin layers to the action of ultraviolet light in an atmosphere of CO_2 gas was not inactivated with respect to vitamin A, but on exposure for from 6 to 10 hours to a current of ozone in a dark bottle impervious to light it became so inactivated that large doses failed to promote growth in rats on a diet otherwise deficient in vitamin A.

This is thought to prove conclusively that ozone inactivates vitamin A in active oils and fats, a finding in agreement with the observations of Hopkins and of Drummond and Coward noted above.

A note on the relative activity of the fat-soluble accessory factor in cod liver oil and butter, S. S. Zilva and M. Miura (*Lancet*) [*London*], *1921, I, No. 7, p. 323*).—The authors call attention to the remarkable therapeutic value of cod liver oil, especially in the treatment of rickets, and to the probability as suggested by Mellanby (E. S. R., 41, p. 364) that its action is due to the presence of vitamin A. It is suggested that the superiority of cod liver oil in this respect over other substances containing vitamin A is due to its remarkably high content of the vitamin. A sample of crude unrefined cod liver oil was found to be 250 times as potent as butter, and refined oil, while less potent than the crude oil, was of considerably greater value with respect to vitamin A than

butter. In view of the recent findings of Hopkins, Drummond and Coward, and Zilva in regard to the instability of vitamin A when exposed to air or ozone, as noted above, the difference in potency of crude and refined oil is suggested as being due to partial destruction of the vitamin during the process of refining.

The influence of aeration on the stability of the antiscorbutic factor, S. S. ZILVA (*Lancet* [*London*], *1921, I, No. 10, p. 478*).—In this preliminary note the author reports briefly the results of experiments which indicate that the antiscorbutic vitamin is inactivated by aeration, an observation suggested as a possibility by Delf (E. S. R., 43, p. 567).

Lemon juice from which the organic acids were removed by precipitation with $CaCO_3$ was used as the source of the antiscorbutic vitamin, the minimum protective dose for guinea pigs of such a solution being about 1.5 to 2 cc. On aspirating air through the solution for 12 hours at laboratory temperature, daily doses of 3 and 5 cc. proved insufficient to prevent, but delayed slightly, the onset of scurvy in guinea pigs, and 7 cc. was inadequate for promoting growth. Daily doses of 1.5, 3, and 6 cc. of the decitrated juice which had been boiled for 1 hour with constant aeration proved insufficient to prevent or delay the onset of scurvy, while daily doses of 1.5, 4, and 6 cc. of the juice boiled for 2 hours in an atmosphere of CO_2 provided ample protection.

Attention is called to the similarity in behavior of the antiscorbutic and fat-soluble vitamins to heat and aeration, while the antineuritic factor is apparently more stable to oxidation. "All the data available in connection with the behvior of the antiscorbutic and the fat-soluble factors at high temperatures will have to be reconsidered in view of the latest results obtained as regards their great tendency to be inactivated on aeration, especially when heated."

Effect of a ration low in fat-soluble A on the tissues of rats, M. DAVIS and J. OUTHOUSE (*Amer. Jour. Diseases Children, 21 (1921), No. 3, pp. 307–311*).—A brief report is given of the histological examination of the organs of three generations of rats on a deficient diet consisting of crushed oats, polished rice, and skimmed milk ad libitum, supplemented by a limited amount of cooked potato and egg white.

The typical symptoms of xerophthalmia appeared in from four to five months in rats on this ration. Other pathological conditions noted were distention of the stomach and intestines with gas, marked anemia, and fragility of the bones. Histological examination of the principle organs showed few changes. The heart, pancreas, liver, and testes were normal in most cases, while the kidney and spleen showed slight changes, principally congestion and chronic inflammation.

The nutritional requirements of yeast, E. I. FULMER, V. E. NELSON, and F. F. SHERWOOD (*Jour. Amer. Chem. Soc., 43 (1921), No. 1, pp. 186–199, figs. 5*).—The nutritional requirements of yeast have been made the subject of an extensive investigation, which is reported in part in the following papers:

I. *The rôle of vitamins in the growth of yeast* (pp. 186–191).—The general method employed in this and the following paper consisted in studying the effect on the growth of yeast of the addition to a standard medium of known amounts of the material to be tested. To determine the effect of water-soluble B, water solutions of evaporated alcoholic extracts of ether-extracted wheat embryo and alfalfa were added in varying amounts to a basal medium, 100 cc. of which contained 0.3 gm. of ammonium sulphate, 0.2 gm. of monopotassium phosphate, 0.025 gm. of magnesium sulphate, and 10 gm. of cane sugar, and their effect upon the growth of yeast determined. The yeast growth curves obtained were similar in showing optimum concentrations for the material in question, but were unlike in that the optimum concentration of the alfalfa extract (1.2

gm. dry weight per 100 cc. medium) was far more potent than the wheat embryo extract at its optimum concentration of 0.06 gm. dry equivalent. This is thought to indicate that the relative potencies of two materials can not be determined by comparing the effects of extracts of equal weights of the materials, but instead the optimum concentration of each material must first be determined.

When the extracts were heated for an hour with 5 per cent NaOH under pressure and after neutralization again tested as yeast stimulants, no decreased activity was noted, thus indicating that the stimulant is not water-soluble B, which is known to be inactivated by treatment with alkali. Further experiments on the growth of yeast in a medium consisting of the optimum concentration of alfalfa or of wheat embryo plus 10 per cent sugar indicated that the extract contained sufficient nitrogenous and inorganic constituents for the growth of yeast. Further proof that water-soluble B is not necessary for the growth of yeast was obtained in the development of a synthetic medium of known constituents which has not been improved by the addition of vitamin-containing extracts.

II. *The effect of the composition of the medium on the growth of yeast* (pp. 191–199).—This paper reports in detail the investigation of the influence of the nature and concentration of known components of the medium on the growth of yeast, which has resulted in the development of the optimum medium for yeast growth at 30° C. as noted above. This medium, which contains in 100 cc. ammonium chlorid 0.18, calcium chlorid 0.1, dipotassium phosphate 0.1, precipitated calcium carbonate 0.04, dextrin 0.6, and cane sugar 10 gm., is said to give better growth in yeast than can be obtained with Williams's medium (E. S. R., 41, p. 670) with the addition of alfalfa extract.

Attention is called to the fact that the optimum concentration of ammonium chlorid for the growth of yeast is the concentration of the salt in which the protein (wheat gluten) is least swollen.

The nutritive value of extra-yeast bread, P. B. Hawk, C. A. Smith, and O. Bergeim (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 4, pp. 110, 111*).—A brief note is given of experiments illustrating the superior nutritive value of extra-yeast bread.

Eleven rats, on a diet of white bread, salts, and butter fat, grew very poorly with an average gain in weight of 18 gm. in 9 weeks, while another group of 11 rats of the same initial weight, on a diet similar to the preceding with the exception that 5 per cent of dried yeast was added to the flour and extra fresh yeast used in making the bread, made an average gain of 59 gm. The extra gain is attributed to the high content of vitamin B in the extra-yeast bread and to the supplemental action of the complete protein of the yeast.

The nutritive value of lard, J. C. Drummond, J. Golding, S. S. Zilva, and K. H. Coward (*Biochem. Jour., 14 (1920), No. 6, pp. 742–753, pl. 1, figs. 7*).—The mooted question of the presence of vitamin A in lard was made the subject of an extensive investigation along two lines as follows:

I. *Influence of diet of pigs on the vitamin content of pig fat* (pp. 743–748).—This study consisted briefly in placing 5 groups of pigs of the same litter at weaning on experimental rations of toppings and whey, toppings and grass, full mixed diet with grass, toppings, whey and grass, and toppings and a synthetic whey. At the end of 3 months the animals were slaughtered, and samples of the back and perinephritic fat in small cubes weighing about 1.5 gm. were used as a supplement to the basal ration of rats whose growth had been brought to a standstill by a deficiency of vitamin A. Growth curves and photographs of the slaughtered animals showed that growth was much better on the diets rich in A. The body fats of the animals fed on diets deficient in

vitamin A were found to be of no value as a source of that vitamin, while those of the grass-fed animals, particularly those receiving a mixed ration, contained appreciable amounts of A.

"These experiments demonstrate that storage of the vitamin A will occur in the body fat of the pig, provided that the animal receives a diet containing considerable amounts of that substance. This finding is of importance, since it shows that the pig is not an exception to the rule that storage of the fat-soluble vitamin A in the fat depôts occurs in animals under suitable conditions. It does not appear that pig fat, weight for weight, is as rich in vitamin A as is the body fat of other animals fed on a similar type of diet. This may, however, be due to the fact that the mass of adipose tissue is so much greater in the former species, and that the concentration of vitamin per unit weight of fat would tend to be smaller than in a species such as the cow, where fat deposition is less marked."

II. *Influence of the processes employed in the manufacture of lard on the vitamin present in pig fat* (pp. 748–753).—In this study samples of pig fat such as used at a modern lard factory and samples of lard made from the same batch of fat were tested in the usual way for vitamin A. The untreated pig fat was found to contain appreciable amounts of A, while the samples of lard were inactive. A single sample of lard prepared in the same factory from very active back fat was found to possess some activity, although not nearly so pronounced as that observed by Daniels and Loughlin (E. S. R., 43, p. 764).

The absence of vitamin A or its very low content in commercial lard is attributed to two causes. "First, the diet usually given to fattening pigs in this country is seldom rich in vitamin A, so that the average sample of pig fat contains little or none of that substance; secondly, the processes of lard manufacture undoubtedly cause the destruction of much of the vitamin present in the original pig fat, probably owing to the exposure of the fat to oxygen at high temperature."

Note on the vitamin content of milk, F. G. Hopkins (*Biochem. Jour., 14 (1920), No. 6, pp. 721–724, figs. 4*).—In reply to the paper by Osborne and Mendel (E. S. R., 43, p. 165), in which they report inability to obtain satisfactory growth in young rats with small amounts of milk as a source of vitamin B as previously reported by the author (E. S. R., 28, p. 260), a series of 4 experiments involving from 8 to 18 rats is reported, the results of which confirm the author's earlier experiments. It is noted, however, that successful experiments were conducted in the spring, while earlier attempts in the winter were not so successful. That the apparent seasonal variation in these results is not due to differences in the milk is considered probable in view of the results of Osborne and Mendel, and also from an incomplete observation included in the present paper of the properties of the milk of goats on winter and summer feed. Rats on the dietary including the summer milk grew if anything less well than those on the winter milk.

Nitrogenous equilibrium and vitamin deficiency, A. Desgrez and H. Bierry (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 20, pp. 1209–1211*).—To determine whether or not nitrogen equilibrium is susceptible of being influenced by the nature as well as the calorific value of the other constituents of the diet, adult male rats were placed on a diet of salts, water, egg albumin, pure sugars (sucrose, lactose, and *d*-fructose), and fats free from nitrogen (pork, mutton, and beef fat). The amounts of salts were kept constant, while the proportions of the other ingredients were altered. By following the nitrogen balance with varying combinations the necessary proportions to attain nitrogen equilibrium were determined.

It was found possible to maintain equilibrium for 3 periods of 8 days each with the same rat on diets containing per gram of rat per day (1) protein 0.009, sugar (sucrose 95 and lactose 5 parts) 0.02, and fat (lard 1 part and mutton fat 0.5 part) 0.019 gm.; (2) protein 0.008, sugar (the same composition as in 1) 0.018, and fat (1 part of lard, 1 of beef fat, and 0.5 of mutton fat) 0.02 gm.; and (3) protein 0.0046, sugar (levulose 50, lactose 4, and sucrose 46 parts) 0.022, and fats (the same composition as in 2) 0.019 gm. The authors conclude that rats can be maintained for a certain length of time in nitrogen equilibrium on a diet deficient in vitamins and of varying proportions of protein, fats, and sugar, but furnishing a fixed and sufficient energy value. The minimum of each of the three constituents is determined by the chemical nature and ratio of the other two constituents. The minimum of nitrogen is obtained when sugar is present to a certain extent in the diet.

Nitrogen equilibrium and carbohydrates in the food ration, A. Desgrez and H. Bierry (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 26, pp. 1393–1396*).—This paper reports a continuation of the study noted above by attempts to determine the amount of sugar necessary to establish nitrogen equilibrium in rats on diets containing given amounts of protein and fat, the same method of procedure being followed as in the preceding study.

It was first noted that on passing abruptly from the ordinary to the synthetic diet containing a high proportion of protein and fat with respect to sugar the animal lost nitrogen rapidly. On decreasing the amount of the same protein and fat and correspondingly increasing the amount of sugar, however, nitrogen equilibrium was promptly attained.

With a ration comprising per gram of rat per day 0.0078 gm. of egg albumin, 0.016 of fat (1 part of beef, 0.5 of mutton, and 1.5 of pork fat), and 0.019 gm. of sugar consisting of 10 parts of lactose and 90 of sucrose, the nitrogen balance for 3 successive days was −0.004, +0.024, and +0.02 gm. On decreasing the amount of sugar and replacing it by an isodynamic equivalent of fat the nitrogen balance became negative on the following day and by returning to the original diet again became positive. By keeping the amount of fat and salts fixed, decreasing the amount of protein, and increasing the sugar nitrogen equilibrium was obtained with 0.0047 gm. of protein, 0.016 of fat, and 0.022 of sugar, the latter consisting of 45 parts of sucrose, 5 parts of lactose, and 50 parts of levulose. The authors conclude that beyond a certain limit carbohydrates can not be replaced by any other food material.

The antiscorbutic action of whole and pressed raw potato, Bezssonoff (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 1, pp. 92–94*).—The author reports the results of a comparative study of the antiscorbutic action of raw white potato and the same potato crushed in an hydraulic press and administered as the juice and marc, both being fed to guinea pigs in addition to oats and water. The juice and marc of the pressed potato proved inferior in antiscorbutic properties to the whole raw potato. The extracted juice possessed some antiscorbutic power, but the marc alone was almost without effect. With the whole raw potato 15 gm. proved sufficient to prevent scurvy, while 40 cc. of the juice appeared to be the minimum protective dose.

Malnutrition, T. Clark (*Pub. Health Rpts. [U. S.], 36 (1921), No. 17, pp. 923–930*).—This is an adaptation of an article originally prepared for the Child Hygiene section of the U. S. Public Health Service by L. E. Holt. The symptoms, causes, and treatment of malnutrition are briefly discussed, and suggestions are given for proper dietaries for infants and older children. A height and weight table for boys from 5 to 18 years of age is included.

The genesis of edema in beriberi, R. McCarrison (*Roy. Soc. [London], Proc., Ser. B, 91 (1920), No. B 636, pp. 103–110, figs. 3*).—The conclusions con-

cerning the effect of deficient dietaries upon the adrenal glands previously reached by physiological methods of adrenalin estimation (E. S. R., 44, p. 262) have been confirmed by chemical determinations of the adrenalin content of the adrenals of 22 pigeons suffering from polyneuritis as the result of a dietary of autoclaved milled rice. In the 10 cases in which edema was present the quantity of adrenalin greatly exceeded that found in health, and also with two exceptions exceeded that found in dry beriberi.

"Whatever the function of the adrenal medulla may be, the excessive production of adrenalin under conditions of 'vitaminic' deficiency is concerned with the causation of the edema found in this order of cases. It must, therefore, be taken into consideration as a possible factor in the causation of edema in general."

Famine-dropsy as a food-deficiency disease, J. A. NIXON (*Bristol Med. Chirurg. Jour., 37 (1920), No. 140, pp. 137–148*).—The author describes briefly famine-dropsy (war edema or hunger edema) as it occurred in French prisoners of war during the recent war. The disease is characterized by four principal symptoms, edema, polyuria, bradycardia, and asthenia, and is differentiated from similar conditions due to beriberi by the absence of nerve changes, from scurvy by the absence of characteristic scorbutic changes, and from pellagra by the absence of characteristic skin lesions and mental changes seen in pellagrins. The condition occurs as the result of prolonged underfeeding, not of a single food factor, but of proteins and calories. The fact that the diet of most of the subjects had been extremely liquid is thought to indicate that excessive intake of fluid is essential to the production of edema. Rest in bed, warmth, and a diet rich in carbohydrates and adequate in protein brought about prompt recovery if the condition had not progressed too far. Cod liver oil is said to be an excellent remedy.

Ophthalmia and diet, T. B. OSBORNE and L. B. MENDEL (*Jour. Amer. Med. Assoc., 76 (1921), No. 14, pp. 905–908*).—A brief review is given of the literature on the relation to a lack of fat-soluble vitamin of the eye disorder variously known as xerophthalmia, keratomalacia, or the more general term ophthalmia. The literature reviewed also includes early references, before the vitamin hypothesis had been established, to serious eye conditions occurring in improperly nourished animals. As a further contribution to the study of the relationship between ophthalmia and lack of vitamin A, the authors have tabulated the incidence of eye disease in 1,000 rats from their laboratory, representing essentially the entire group under study during one year. All of these animals were kept in the same laboratory and were not grouped according to any system of feeding.

Of the entire number of animals 69 out of 136 on diets deficient in vitamin A showed symptoms of eye disease, while none of the other animals showed any such symptoms, although over half were on diets deficient in one respect or another. Contrary to the findings of Stephenson and Clark (E. S. R., 44, p. 262) that the eye disease begins at a later date than nutritive decline, the eye symptoms in 33 of the 69 animals were noted at approximately maximum body weight before nutritive decline set in, in 15 after a decline of from 10 to 20 gm. from the maximum weight, in 13 after a decline of from 20 to 30 gm., and in only 8 after a decline of more than 30 gm. Administration of vitamin A has almost invariably led to the disappearance of the eye disorder, even though the animal later died. Local antisepsis was of no avail.

The author's observations also indicate that the requirements of the growing rat for vitamin A become less as the animal approaches maturity, in harmony with observations of Drummond and Coward (E. S. R., 44, p. 764), and further

that ophthalmia rarely occurs in full-grown animals even on diets poor in vitamin A.

Ophthalmia associated with a dietary deficiency in fat-soluble vitamin A.—A study of the pathology, I. M. WASON (*Jour. Amer. Med. Assoc., 76 (1921), No. 14, pp. 908–912, figs. 5*).—This paper discusses the pathology of the eye manifestations resulting from lack of vitamin A on the basis of gross and histological changes in the eyes of 9 rats on a diet lacking vitamin A, one lacking B, and one on a normal diet, all from the groups described in the above paper.

The eyes of the 2 animals on the normal diet and the diet lacking only vitamin B showed no pathological changes, while those of the other group showed lesions varying from a very mild change to a panophthalmitis. A partial bacteriological study showed the presence of numerous bacterial masses on the corneal surfaces and on the conjunctival sacs, with occasional bacteria scattered through the inflamed cornea and conjunctival tissues. The organisms found were almost invariably of the coccoid or diplococcoid variety.

The author concludes that while the primary etiological factor in the ophthalmia of rats on deficient diets is the lack of vitamin A, the nature and mechanism of the change in these rats whereby their corneas are rendered susceptible to bacterial invasion are unknown. The course of the disease is determined in part at least by the type and virulence of the organisms of the secondary infection, and the degree to which restoration is possible depends upon the extent of the secondary injury.

Food poisoning: Botulism, R. B. EDMONDSON and C. THOM (*Ohio Dept. Agr. Off. Bul., 14 (1921), No. 2, pp. 35–41*).—The authors describe the general symptoms of botulism, and outline the laboratory procedure for the identification of *Bacillus botulinus* in suspected foods and its isolation in pure culture.

Botulism and spoiled canned food (*Pub. Health Rpts. [U. S.], 36 (1921), No. 15, pp. 751, 752*).—Attention is called to a fatal case of botulism occurring in Seattle, Wash., in February, 1921, from eating three small pieces of home-canned string beans, the spoiled condition of which was clearly recognized.

"It is evidently impossible to accomplish the removal of all spoiled food from the market or to provide against all conditions in which spoiled food may be presented to the housekeeper from time to time. In view of these limitations it is necessary to bring about a general recognition of the dangerous character of food which shows clear physical evidences of spoilage, and to call attention to the stringent necessity of discarding all canned goods deviating from the normal."

ANIMAL PRODUCTION.

The utilization of calcium compounds in animal nutrition, E. B. FORBES ET AL. (*Ohio Sta. Bul. 347 (1921), pp. 99, figs. 2*).—This bulletin consists of six papers as follows:

1. *The metabolism of calcium compounds by growing swine, I,* E. B. Forbes, J. O. Halverson, L. E. Morgan, and J. A. Schulz (pp. 3–36).—The authors report mineral balance experiments in November and December, 1917, with 5 Poland China barrows receiving various mineral supplements with a basal ration of corn meal, wheat middlings, and linseed meal (7:1:1) to which common salt had been added in the proportion 1:450. The supplements fed and a summary of the storage data for calcium, magnesium, and phosphorus are included under experiment 1 in the following table. The special steamed bone flour was not packers' steamed bone, but a gelatin by-product characterized by comparative freedom from impurities and odor.

Influence of mineral supplements on the balance of calcium, magnesium, and phosphorus in pigs.

Additions to ration of corn, linseed meal, middlings, and common salt.	Intake per kg. live weight.			Stored per kg live weight.			Intake stored.		
	Ca.	Mg.	P.	Ca.	Mg.	P.	Ca.	Mg.	P.
Experiment 1:	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Per ct.*	*Per ct.*	*Per ct.*
None	21	63	138	− 6	−3	+12	−30.4	−4.0	+ 8.5
Powdered limestone	113	67	138	+56	+1	39	+49.9	+2.0	28.4
Precipitated bone flour	89	67	168	50	2	35	56.1	2.7	21.0
Rock phosphate floats	99	60	163	34	0	26	34.7	.5	15.6
Special steamed bone flour	76	48	129	38	1	27	50.5	1.1	20.6
Precipitated calcium carbonate	99	52	111	57	2	36	57.8	3.1	32.2
Experiment 2:									
Precipitated bone flour	112	64	186	46	3	33	41.1	4.0	17.8
Precipitated bone and steamed bone flour (1:1)	102	70	189	44	3	36	43.6	4.6	18.9
Precipitated bone and powdered limestone (9:1)	89	76	189	43	3	33	47.7	3.4	17.5
Special steamed bone flour	74	61	152	38	2	28	51.0	2.9	18.4
None	18	56	119	0	0	9	1.3	− .1	7.8

The metabolism of sodium, potassium, chlorin, sulphur, and nitrogen was also studied, but except in the case of chlorin the different mineral supplements seemed without influence on the storage. All the mineral supplements used, and particularly precipitated bone flour, increased the chlorin stored in comparison with the basal ration alone. Attention is called to the fact that phosphorus storage was facilitated by calcium carbonate preparations as well as by materials characterized by high phosphate content. The carbonate preparations lowered the acidity and ammonia content of the urine, while precipitated bone flour owing to the large proportion of dicalcic phosphate caused an increase. About two-thirds of the sodium and potassium leaving the body was contained in the feces, whereas usually over 90 per cent of the chlorin excreted appeared in the urine. The alimentary tract was the main path of excretion for calcium, magnesium, and phosphorus. The mineral supplements were without effect on the digestibility of the organic nutrients.

The authors criticize the conclusion of Lamb and Evvard (E. S. R., 42, p. 266) that the feeding of sulphuric acid to swine did not affect the storage of calcium, and claim that a proper interpretation of the data of these investigators indicates that 25 per cent less calcium was stored.

2. *The metabolism of calcium compounds by growing swine, II*, E. B. Forbes, J. O. Halverson, J. A. Schulz, and E. B. Wells (pp. 37–59).—A second mineral balance experiment was conducted from August to October, 1918, with four Poland China barrows, the main purpose being to compare mixed mineral supplements with the unmixed preparations. The calcium, magnesium, and phosphorus results are given under experiment 2 in the above table. The metabolism of other elements was studied as in the first experiment and with essentially the same results, although a relatively larger proportion of potassium was excreted through the urine. Attention is called to the independence of sodium and chlorin in their metabolic behavior.

3. *The effects of mineral supplements on the development of swine, I*, E. B. Forbes and J. A. Schulz (pp. 60–68).—Thirty Duroc-Jersey pigs, averaging about 62 kg. (136.4 lbs.) in weight, were divided into 5 lots and fed experimental rations for 86 days, beginning April 30, 1917. The basal ration was the same as in the experiments noted above, and the four mineral supplements used were fed in amounts to supply 5 gm. of calcium per pig per day. At the end of the experiment the pigs were slaughtered and physical and chemical determinations were made of the skeleton. The pigs in the lots fed precipitated

calcium carbonate and special steamed bone, respectively, had relatively dense and strong bones, while the bones of the pigs fed rock phosphate were only slightly more dense than the bones of the pigs fed the unsupplemental ration, had a lower breaking strength than the latter, and contained less ash per unit of volume. The bones of pigs fed precipitated bone flour were intermediate in density and in breaking strength. There was a high proportion of phosphorus to calcium in the bones of pigs fed either rock phosphate or the unsupplemented ration, and in those slaughtered to determine initial composition. In the latter (young) pigs the magnesium in the bones was low relative to the calcium.

4. *The effects of mineral supplements on the development of swine, II*, E. B. Forbes, C. H. Hunt, J. A. Schulz, and A. R. Winter (pp. 69–83).—The experiment reported, which began July 26, 1919, and lasted about 16 weeks, differs from the preceding mainly in that the mineral supplements were fed ad libitum, more supplements were tested, and a greater number of different determinations were made of the physical characteristics of the bones. There were 8 lots of 5 pigs having an initial weight of about 21 kg. per head. The basal ration consisted of corn meal, wheat middlings, and linseed meal (3:1:1) with common salt in the proportion of 1:500. Mineral supplements were fed to 7 lots in a self-feeder, sodium chlorid being mixed with each supplement to the extent of 3 per cent. During the first 5 weeks, when the pigs had access to a dirt lot, they showed little interest in the mineral supplements, but later when confined to brick paved lots they consumed them in large quantities. The supplements offered the several lots, the amounts consumed, and some of the characteristics of the bones determined after slaughter are given in the following table:

Influence of mineral supplements fed ad libitum on the bones of pigs.

Lot.	Mineral supplements fed.	Supplement taken per head daily.	Calcium in supplement taken.	Breaking strength.		Penetrability of tibia	Ash per cc. in tibia.	Composition of dry fat-free bone.			
				Humerus.	Tibia			Ca	Mg.	P.	CO_2.
		Grams.	*Grams.*	*Pounds.*	*Pounds.*	*Micra.*	*Mg.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	Rock phosphate floats	12.1	3.72	466	332	71.7	783	59.8	1.75	31.1	7.40
2	Powdered limestone	20.1	7.84	591	404	56.3	774	60.1	1.49	30.3	8.15
3	Special steamed bone	41.3	12.38	601	429	44.2	826	60.3	1.39	29.9	8.43
4	Whiting	14.0	5.23	538	367	51.6	777	60.6	1.48	29.8	8.18
5	Precipitated bone flour	21.9	5.39	548	388	52.6	803	60.8	1.49	29.8	7.94
6	Precipitated $CaCO_3$	13.6	5.25	596	442	63.4	804	60.8	1.56	29.3	8.31
7	Marl	6.8	2.41	545	346	58.7	762	60.5	1.52	29.3	8.72
8	None	.....	.....	435	289	53.1	722	60.8	1.58	30.1	7.46

The penetrability was determined by a specially designed microdynamometer which measures the penetration of a diamond punch 0.02 in. in diameter under a pressure of 20 lbs. A transverse section of the bone sawed from the narrowest point of the shaft and ground in another machine to make the sides parallel was used in this determination.

Attention is called to the fact that the hardest bones (lot 3) were characterized by high proportions of calcium, carbon dioxid, and ash, and the minimum magnesium content, whereas the softest bones (lot 1) contained the highest proportions of magnesium and phosphorus and the lowest calcium and CO_2 content. The differences between these two lots are thought to indicate the relative values of rock phosphate floats and special steamed bone flour as mineral supplements to growing animals.

It is suggested that the mineral substance of bone is a mixture of carbonates and phosphates susceptible of modification through the selective withdrawal of carbonates to constitute a portion of the alkali reserve of the body. In lots 1 and 8 the low proportion of CO_2 to phosphorus in the bones is held to indicate that such a withdrawal of calcium carbonates occurred in response to deficiency of potential alkali. This leads to a softer bone, owing to the high proportion of magnesium phosphate.

5. *The palatability of mineral salt preparations to swine, cattle, and horses*, E. B. Forbes (pp. 84–95).—The author reports 19 palatability tests with swine and 15 with cattle, and makes the statement that some horses will take precipitated bone and special steamed bone readily. Several of the experiments have been noted from a preliminary paper (E. S. R., 44, p. 175).

The new experiments with swine showed that special steamed bone, in many ways the most palatable supplement tested, could be improved in this respect by being acidified slightly. Tankage added materially to the palatability of the mineral substances with which it was mixed. It appeared to be more effective than dried blood or fish scrap. Coriander seed and molasses tended to increase the palatability of the mineral, but they were not so valuable as tankage. Among materials of no special value in increasing palatability for swine were anise, fenugreek, caraway and fennel seeds, ginger, charcoal, humus, and ground alfalfa hay. Preparations in the form of a light dust caused discomfort.

6. *The alkali reserve of swine as affected by cereal feeding and mineral supplements*, E. B. Forbes, J. O. Halverson, and J. A. Schulz (pp. 96–99).—Two pigs were fed the basal ration of corn, middlings, linseed meal, and sodium chlorid for 33 days. This was followed by a period of 25 days in which precipitated calcium carbonate was added, and then by a period of 23 days in which the basal ration was supplemented with precipitated bone phosphate. The supplements were given in the proportion of 0.2 gm. per kilogram of live weight.

The feeding of calcium carbonate, which is potentially basic, increased the CO_2 tension in the blood plasma and decreased the ammonia content and the H-ion concentration of the urine. Bone phosphate, which is potentially acid, had the reverse effect, and it is concluded that the alkali reserve of the blood plasma may be markedly altered by the nature of the mineral matter fed.

Report of committee on stock feed, E. H. W. Broadbent (*Hawaii Sugar Planters' Assoc. Proc., 40 (1920), pp. 59–93*).—This is a report of a survey of the use of local feeds for horses, mules, and work oxen on sugar plantations in Hawaii. The principal feeds used are cane tops, waste molasses, cassava meal, alfalfa, and keawe bean meal.

Sugar beet top silage, R. E. Neidig (*Idaho Sta. Circ. 17 (1921), pp. 4*).—The author reports analyses of 10 samples of beet-top silage which he has previously published elsewhere (E. S. R., 44, p. 768), and suggests that the quality of the silage could be improved by care in eliminating dirt and the use of deep pit silos instead of shallow trenches.

Chamiza as an emergency feed for range cattle, L. Foster, J. L. Lantow, and C. P. Wilson (*New Mexico Sta. Bul. 125 (1921), pp. 29, figs. 11*).—Ten aged range cows, mostly with calves at side, were grazed on unirrigated pasture consisting mainly of the chamiza bush (*Atriplex canescens*) for 285 days, beginning January 30, 1920. Two of the cows gained in weight and the others lost, but the loss was moderate, except in one case, where rapid decline was checked by feeding alfalfa hay throughout the summer. Half the cows received a ration of 1 lb. of cottonseed meal until September 18, but the benefit was trifling, since chamiza leaves are high in protein. The calves were fed alfalfa hay and small amounts of cottonseed meal, and made what is considered good growth. Although chamiza is reported to be slightly poisonous to sheep, it

did not affect the health of the cows nor interfere with calving. Chemical analyses of the plants previously reported (E. S. R., 43, p. 374) are reprinted.

[Cattle feeding at the Scottsbluff Substation, Nebraska] (*Nebraska Sta. Rpt. 1920, pp. 35, 36*).—In 1920 a dry-land range pasture of 800 acres carried 82 steers for 142 days, beginning June 3. The 35 2-year-olds made an average gain of 223 lbs. per steer and the yearlings about 200 lbs.

In a steer feeding experiment during the winter of 1919–20 it was found that silage produced more gain than beet tops when added to a standard ration of alfalfa hay, dried beet pulp, and cottonseed cake.

Lamb feeding investigations, 1919–20, A. M. Paterson and H. B. Winchester (*Kansas Sta. Circ. 88 (1921), pp. 6, fig. 1*).—The results of two lamb feeding trials are reported, both involving comparisons between hand-feeding and self-feeding, and variations in the concentrate rations.

Five lots of 40 lambs each, averaging about 55 lbs. in weight, were used in the first experiment, which began November 2, 1919, and lasted 64 days. Four lots were hand-fed and received a ration of 1.25 lbs. of grain and 0.14 lb. of linseed meal in addition to alfalfa hay and cane silage. The self-fed lot consumed 1.4 lbs. of shelled corn and 0.55 lb. of linseed meal per head per day, used less roughage than the hand-fed lots, made the best gain (0.51 lb. per head daily), showed the most finish, and had the highest dressing percentage. The hand-fed lot fed shelled corn gained 0.48 lb. per head daily. The lot fed shelled corn and a proprietary tonic gained at the rate of 0.47 lb. The lot fed ground corn also gained 0.47 lb. per day, while the lot fed whole barley gained 0.43 lb., showed the least finish, and had the lowest dressing percentage.

The second experiment began February 8, 1920, lasted 30 days, and included six lots of 35 lambs each. The initial weight averaged about 73 lbs. and the final weight about 90 lbs. The standard ration (hand fed), consisting of 1.1 lbs. of shelled corn, 0.23 lb. of linseed meal, 1.1 lbs. of alfalfa hay, and 2 lbs. of corn silage, produced a daily gain of 0.55 lb. per head. Exactly the same gain was produced when these feeds were offered free choice, in which case 1.52 lbs. of shelled corn and 0.49 lb. of linseed meal were consumed per head per day, and the silage consumption was cut in half. When linseed cake was omitted from the standard ration (hand fed) the gain was only 0.42 lb., although a similar combination, offered free choice, produced a gain of 0.54 lb., the corn ration being 1.62 lbs. The hand-fed lot receiving 0.34 lb. of corn gluten feed in place of linseed meal gained at the rate of 0.56 lb. The remaining lot on a simple ration of corn and alfalfa hay gained 0.47 lb. and showed the least finish.

Rations for fattening lambs (*Nebraska Sta. Rpt. 1920, pp. 23, 24*).—In a 98-day test, beginning October 21, 1919, it was found that the addition of silage to a ration of corn and alfalfa hay increased the gain, but that the increased gain was practically negligible if either molasses or linseed meal were included in the ration.

Feeding lambs [at the Scottsbluff, Nebr., Reclamation Project Experiment Farm], J. A. Holden (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 34–36*).—Data on a 100-day feeding experiment in the winter of 1919–20, conducted in cooperation with the Nebraska Experiment Station, are tabulated. There were 12 lots of 31 lambs each, averaging about 45 lbs. in weight. All lots received alfalfa hay ad libitum. The greatest gains were made on a ration of cottonseed cake (⅓ lb.), dried beet pulp (1 lb.), and corn silage (2 lbs.), and the next best gain was made by a lot fed a similar ration with unlimited amounts of beet tops in place of silage. The least gains were made when beet pulp was dropped from these rations. Beet pulp produced less rapid gains than corn whether fed alone or with cottonseed cake, but with the price scheduled used the beet pulp proved more profitable.

[Alfalfa as pasture for hogs and sheep at the Scottsbluff Reclamation Project Experiment Farm], J. A. HOLDEN (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 12–16*).—The 1917 pasture tests (E. S. R., 40, p. 470) were repeated in 1918, 4 lots of 10 84-lb. pigs being grazed for 135 days. As in 1917, the 2 half-acre plats were overgrazed, but the subdivision and alternate pasturing caused an increase in the gain and economy of gain. The acre plats yielded some hay in addition to the forage, and the gains were not influenced greatly by alternate pasturing.

The long-term pasture test of alfalfa in rotation 65 was continued in 1919. The quarter-acre plat was grazed by 6 fall pigs during the spring period and by 10 spring pigs during the summer period. These pigs made a total gain of 3,192 lbs. per acre and consumed 2.67 lbs. of corn per pound of gain.

Two other pasture trials with hogs are reported, one dealing with the limitation of grain rations on pasture and the other with the feeding value of Turkestan alfalfa. In the details of the experimental procedure outlined these tests are identical with tests reported from the Scottsbluff Substation in the 1919 Report of the Nebraska Station (E. S. R., 43, p. 673), but the gains and feed consumption given are not the same. In the first of the experiments, lot 1 (on a full feed of corn and access to an undivided acre of alfalfa) gained 1,475 lbs. in 90 days, lot 2 (on a limited corn ration and an undivided acre of pasture) gained 1,256 lbs. in 120 days, and lot 3 (on a limited corn ration with access to a half-acre subdivided to permit alternate pasturing) gained 1,158 lbs. in 120 days. The corn consumed per pound of gain averaged 3.65, 3.48, and 3.98 lbs., respectively. In the comparison of alfalfa varieties in 1918 and 1919, the average corn consumption per pound of gain is given as 3.12 lbs. when the hogs were on Turkestan alfalfa and 3.02 lbs. when on common alfalfa.

In the sheep-pasturing experiments deaths from bloat were so numerous in 1918 and 1919 that it is considered inadvisable to pasture sheep on alfalfa, although the gains are very satisfactory.

Swine feeding investigations, 1919–20, E. F. FERRIN and H. B. WINCHESTER (*Kansas Sta. Circ. 89 (1921), pp. 10, fig. 1*).—Three feeding experiments dealing mainly with the value of barley, low-grade wheat, rye, and grain sorghums for feeding pigs are reported. The authors confine themselves to the economy of gain and do not report either the actual feed consumption or the gains made.

To study the methods of preparing barley for pigs on alfalfa pasture, 39 pigs divided into four lots were fed for 120 days, beginning July 1, 1919. The average initial weight was about 37 lbs. The feeds offered the respective lots and the amounts required per pound of gain were as follows: Shelled corn and tankage, 3.36 lbs.; dry ground barley and tankage, 3.78 lbs.; soaked ground barley and tankage, 4.46 lbs.; and soaked whole barley and tankage, 4.66 lbs.

The second experiment was begun September 15, 1919, and lasted 120 days. The pigs had been on alfalfa pasture, but were fed in the dry lot, and 80 pigs averaging 60 lbs. in weight were used. The feeds offered and the amounts required per pound of gain were as follows: Whole wheat and tankage, 4.08 lbs.; ground wheat and tankage, 4.22 lbs.; ground wheat without supplement, 4.67 lbs.; ground wheat and ground rye (1:1), 4.92 lbs.; ground corn and tankage, 5.08 lbs.; ground rye and tankage, 5.1 lbs.; ground rye and ground corn (1:1), 5.18 lbs.; ground rye and wheat shorts (1:1), 5.53 lbs.

The third experiment was begun February 17, 1920, lasted 60 days, and involved two groups of pigs, one farrowed in the spring and the other in the fall. Each group was divided into four lots of 5 pigs each. The lots received corn or grain sorghum, together with tankage, and were fed by the free-choice system.

All the grain was ground, and the following table summarizes the results as to the economy of the rations:

Influence of age of pigs on the relative economy of grain sorghums in a 60-day feeding trial.

Age of pigs.	Initial weight.	Corn ration per pound of gain.			Feterita ration per pound of gain.			Milo ration per pound of gain.			Kafir ration per pound of gain.		
		Grain.	Tankage.	Total.	Grain.	Tankage.	Total.	Grain.	Tankage.	Total.	Grain.	Tankage.	Total.
Mos.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
5½	100	4.54	0.19	4.73	5.00	0.27	5.27	5.07	0.25	5.32	5.58	0.27	5.85
9	150	4.25	.15	4.40	4.09	.17	4.26	4.53	.18	4.71	4.76	.17	4.93

Nutrient requirements of growing chickens (*Nebraska Sta. Rpt. 1920, pp. 17, 18*).—In a brief report of the status of this project, it is stated that a ration of wheat, casein, butter fat, and ash, which is unable to produce normal growth in chicks, was improved in this respect by the addition of about 5 per cent of wheat greens. Green feed also improved a ration of corn, casein, and ash.

A study of the effects of animal and plant protein feeds on the egg production of ducks, A. Goseco (*Philippine Agr., 9 (1921), No. 8–9, pp. 197–207*).—Two lots of 9 ducks and 2 drakes each were fed for one year on a mash of rough rice and rice bran (1:1). Lot A, which consumed 39.3 kg. of mash and 21.3 kg. of live snails per bird in the year, laid 71.95 eggs per duck. Lot B, which consumed 33.1 kg of mash and 12.3 kg. of copra meal per bird, laid 24.39 eggs per duck. The eggs laid by lot A were slightly heavier and a higher proportion were fertile. Both lots lost in weight, the greater loss being in lot B. Both the snails and the copra meal contained about 20 per cent protein.

DAIRY FARMING—DAIRYING.

In memory of Wilhelm Fleischmann, G. Wiegner (*Landw. Vers. Sta., 97 (1921), No. 5–6, pp. 61–292*).—This obituary includes a survey of Fleischmann's pioneer work in dairy science, an appreciation of his interest in the historical and philosophical aspects of agriculture, and a list of his published works (totaling 190 items) arranged chronologically from 1861 to 1919.

[Sweet clover pasture and sunflower silage for dairy cows at the Scottsbluff, Nebr., Reclamation Project Experiment Farm], J. A. Holden (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 16, 17, 26, 27*).—Three acres of sweet clover that had been seeded to wheat in the spring of 1918 were pastured by 10 dairy cows in 1919 from May to September. The cows were unable to consume all the available pasturage. The 4 cows giving milk were alternated every 10 days or two weeks with 4 other cows on grass pasture. The milk yields were slightly greater on the sweet-clover pasture.

In 1917 corn and sunflowers were ensiled in alternate layers about 4 ft. thick. The cows showed a preference for the corn silage, but there were no noticeable fluctuations in milk flow with change from one silage to the other. In 1918 the lower two-thirds of one silo was filled with sunflowers and the upper third filled with corn. It was found that the amounts of silage which dairy stock would eat decreased when the sunflower silage was fed for more than 10 days or two weeks. The milk flow of the cows also dropped. In 1919 sugar-factory molasses to the extent of about 10 per cent of the weight was added to the sunflowers at

the time of ensiling, but even with this addition the sunflower silage was not relished as much as corn silage.

Good and bad sunflower silage, F. L. BALLARD (*Hoard's Dairyman, 62 (1921), No. 5, p. 126*).—This is a discussion of the use of sunflower silage in Oregon, in which the author reports chemical analyses made by the experiment station of samples of the silage collected in three sections of the State.

On the coast and in the Willamette Valley the silage was found to be low in dry matter (less than 17 per cent) and relatively high in acidity (2.24 per cent), and in general seems not to be favored by farmers where corn can be grown. In eastern Oregon the silage contained 21.8 per cent dry matter, was low in acidity (1.42 per cent), and was very similar in composition to samples analyzed at the Montana Station (E. S. R., 43, p. 68). In this less humid region of the State farmers report conspicuous success with sunflower silage, particularly for dairy herds.

Advanced registry testing in Indiana, L. H. FAIRCHILD (*Indiana Sta. Circ. 102 (1920), pp. 16, figs. 5*).—Summaries are given of the advanced registry requirements of the different breeds and the rules for the conduct of tests in Indiana.

The marketing of whole milk, H. E. ERDMAN (*New York: Macmillan Co., 1921, pp. XVI+333, figs. 29*).—In this treatise the author discusses the public interest in milk marketing, the domestic and export markets for whole milk, the problems involved in the transportation and distribution of milk, the history and present status of collective bargaining in the sale of milk, the determination of wholesale and retail prices, and various schemes in use or proposed for the control and stabilization of the milk trade. Much of the information concerning producers' organizations, the cooperative movement, and methods of conducting traffic in milk other than as a competitive business was secured by direct communication with persons concerned in the organization or conduct of these undertakings.

The author points out that the milk marketing problem can not be solved so long as the triangular warfare between producers, dealers, and consumers continues. The most feasible remedy for the situation is thought to be a combination of collective bargaining and the milk commission or milk arbitrator plan. The price-fixing problem is recognized as troublesome, but it is thought that the misunderstanding can be cleared away, given the right kind of collective bargaining, the realization that cost-of-production figures have definite limitations as factors in price determination, and an appreciation of the fact that conditions of supply and demand do control prices.

There is a brief general bibliography on milk marketing and numerous footnote citations to the dairy press concerning special points, particularly historical matters.

Starters for farm cheese making, W. SADLER (*Brit. Columbia Dept. Agr., Dairy Circ. 1 (1921), pp. 5, fig. 1*).—Advice is given as to the care of *Streptococcus lacticus* cultures where cheese is made in small quantities. The use of fireless cookers as incubators is suggested.

Clotted cream, W. SADLER (*Brit. Columbia Dept. Agr., Dairy Circ., 4 (1921), pp. 7, figs. 5*).—Directions are given for the manufacture of Devonshire clotted cream, a dairy product which the author considers unduly neglected, considering the probable profits from its manufacture.

Cooperative manufacturing of ice cream, A. H. DEGRAFF (*Hoard's Dairyman, 62 (1921), No. 5, pp. 107, 128*).—The author suggests that cooperative creameries and cheese factories install the added equipment necessary for them to make ice cream, so that they can devote their main energies to which-

ever dairy product is the most profitable at any particular time. It is pointed out that recent declines in the prices of butter and cheese would in many cases make such a movement desirable at present, since the demand for ice cream seems to be increasing and the price level has remained high.

Dairy industries [in Quebec] (*Quebec Statis. Year Book, 1920, pp. 262–281*).—Statistics of creameries and cheese factories in Quebec in 1911, 1916, 1917, 1918, and 1919 are tabulated, including the numbers of patrons and employees, capital invested, number of cows supplying the factory, amounts of milk received, and amounts of product manufactured. For 1919 the statistics of each plant are given in great detail.

VETERINARY MEDICINE.

Physiology and biochemistry in modern medicine, J. J. R. MACLEOD ET AL. (*St. Louis: C. V. Nosby Co., 1920, 3. ed., pp. XXXII+992, pls. 9, figs. 236*).—In preparing the present edition of this volume (E. S. R., 40, p. 577), the section on the nervous system has been entirely rewritten by A. C. Redfield, the section on the chemistry of respiration has been rearranged and rewritten, and several new chapters and data have been added in other sections.

Microbiology, edited by C. E. MARSHALL (*Philadelphia: P. Blakiston's Son & Co., 1921, 3. ed., rev. and enl., pp. XXVIII+1043, pls. 2, figs. 200*).—In the revision of this textbook on microbiology (E. S. R., 37, p. 76) the names of W. V. Cruess and A. Itano have been added to the list of contributors.

Pathogenic microorganisms, W. J. MACNEAL (*Philadelphia: P. Blakiston's Son & Co., 1920, 2. ed., rev. and enl., pp. XX+488, figs. 221*).—In this textbook on pathogenic microorganisms a brief introductory section is followed by sections on bacteriological technique, general biology of microorganisms, and specific microorganisms. The section on general biology includes chapters on morphology and classification, physiology of microorganisms, the distribution of microorganisms and their relation to special habitats, parasitism and pathogenesis, the pathogenic property of microorganisms, reaction of the host to infection, and immunity and hypersusceptibility with theories of immunity.

Production and inspection of biological products, D. I. SKIDMORE (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 51–61*).—In addition to a brief explanation of the classification, supervision, and control of establishments licensed for the production of biological products, the preparation and properties of clarified antihog-cholera serum noted on page 585 are described, and comparative tables are given of the composition of the different serums manufactured.

Efficiency of commercial biologics, A. EICHHORN (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 241–243*).—In this brief criticism of the conclusions drawn by Van Es and Martin in their study of the value of commercial vaccines against hemorrhagic septicemia and fowl cholera (E. S. R., 43, pp. 882, 887), attention is called to the contrary results obtained by Mack and Records (E. S. R., 37, p. 183) in the use of bacterins in the control of fowl cholera.

The Nebraska hemorrhagic septicemia experiments and the critics, L. VAN ES and H. M. MARTIN (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 572–589*).—This reply to the criticisms of Eichhorn noted above, and of King (E. S. R., 44, p. 580), and others consists chiefly of a review of literature which, in the opinion of the authors, confirms their own conclusions. A list of 32 literature references is appended.

Hemorrhagic septicemia and its control, with special reference to the Nebraska experiments, A. EICHHORN (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 89–98*).—This is a reply to the above paper by Van Es and Martin.

Hemorrhagic septicemia vaccines or bacterins, W. E. KING (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 99–104*).—Another reply to Van Es and Martin.

Cresols and substitutes for cresol soaps.—II, The disinfecting power of pure aqueous cresol solutions, E. HAILER (*Arb. Reichsgsndtsamt., 52 (1920), No. 2, pp. 253–277*).—This is a continuation of the investigation previously noted (E. S. R., 42, p. 675). Neutral aqueous solutions of cresol with a cresol content up to 2 per cent were obtained by dissolving cresol bases in water and neutralizing the aqueous solution with acids or acid salts. On testing these solutions for bactericidal power with various organisms, a concentration of 1 per cent cresol was found to be the optimum at room temperature. *O*-cresol was found to have the weakest and *m*-cresol the strongest disinfecting power.

Report on the anaerobic infections of wounds and the bacteriological and serological problems arising therefrom, W. BULLOCH ET AL. ([*Gr. Brit.*] *Natl. Health Ins., Med. Research Com., Spec. Rpt. Ser., No. 39 (1919), pp. VI+182, pls. 22, figs. 4*).—This is a report of the Medical Research Committee upon Anaerobic Bacteria and Infections.

It is stated that in spite of the accumulation of much knowledge on the subject of anaerobes, a study of the bacteriological literature before the war shows clearly that the descriptions published by different writers agreed in only a few instances. From the frequency with which *Bacillus welchii* (*B. perfringens*) was found, apparently in pure culture, it was considered that this was the chief etiological agent, and it was actually named the bacillus of gas gangrene. Investigations of the discharges from wounds by more refined methods during 1916 and 1917 revealed the fact, however, that gas gangrene could not be regarded as an etiological entity, but could be caused by a series of pathogenic anaerobes acting singly or in combination with each other or in association with certain well-defined nonpathogenic anaerobes. By degrees Pasteur's *Vibrion septique* was disentangled from the mass of anaerobes, and a number of other anaerobes, new to science, were discovered, among which is the highly toxic *B. oedematiens*.

The report is presented under the following headings: The Clinical Features and Treatment of Anaerobic Infection of Wounds and Gas Gangrene, by J. Fraser (pp. 6–15), Incidence of Gas Gangrene (pp. 15, 16), Bacteriology (pp. 16–104), and Serology (pp. 104–145). An extended bibliography (pp. 146–172) and an appendix on The Histopathology of Gas Gangrene, by E. H. Kettle (pp. 173–179), are included. Laboratory experiments have shown that in addition to antitoxin to *B. welchii* and *V. septique* it is necessary to include antitoxin to *B. oedematiens* and *B. fallax*. It is pointed out that the value of antibacterial substances in a gas gangrene serum is not as yet clearly established; such a serum should be given in the earliest possible stage of the disease.

Experimental study of immunization against the bacillus of necrosis, E. CÉSARI (*Bul. Soc. Cent. Méd. Vét., 97 (1921), No. 4, pp. 80–89*).—In continuation of the studies of the necrosis bacillus (E. S. R., 29, p. 478), the author reports an investigation of possible means of immunization, both active and passive, antimicrobial and antitoxic. The rabbit was selected as the subject for antimicrobial and the guinea pig for antitoxic immunization.

It was found possible to produce active immunization in the guinea pig against the action of the toxin of the bacillus, either by subcutaneous or intravenous injection of clear heated serum or by cultures of the organism heated for one-half hour at 55° C., and also to produce passive immunization by the injection of sufficient doses of foreign serum from an animal on which had been conferred a strongly active antitoxic immunity. Rabbits could not be vaccinated

against experimental infection caused by this organism. No experiments with passive immunization were attempted.

The question of blackleg immunization, Y. UCHIMURA (*Schweiz. Arch. Tierheilk., 63 (1921), No. 2, pp. 58–61*).—The author has repeated with guinea pigs and white mice the immunization experiments with blackleg filtrate reported by Gräub and Zschokke (E. S. R., 45, p. 180). In addition to inoculation with 11 strains of blackleg bacilli, the immunized animals were tested against 5 other anaerobic organisms. While the guinea pigs proved immune to the true blackleg strains, no protection against the other organisms was secured. It was found impossible to immunize white mice against blackleg infection by this method. The author concludes that as other pathogenic anaerobes are likely to be associated with blackleg, the blackleg filtrate used for practical immunization should be mixed with similar filtrates from these organisms.

Standarization of botulism antitoxins, I. A. BENGSTON (*Amer. Jour. Pub. Health, 11 (1921), No. 4, pp. 352–357*).—A brief description is given of the methods used by the Hygienic Laboratory, U. S. Public Health Service, for the testing of botulism antitoxins A and B, the method being the same in principle as that used for measuring the potency of diphtheria and tetanus antitoxins.

"Several antitoxins from different sources have been tested at the Hygienic Laboratory and have been found to have unitages ranging from 2 to about 450 per cubic centimeter. Judging from the rather limited number of serums to be tested, it appears that antitoxins against type A toxin, the type which would have been applicable in most of the recent cases of food poisoning due to *Bacillus botulinus*, have been low in potency, some of the earlier ones containing only 2 units per cubic centimeter. Some later polyvalent antitoxins have contained up to about 40 units of type A antitoxin. Very much stronger antitoxins of type B have been received. It also appears from a limited number of observations on the serums received for test that it is difficult to produce 'polyvalent' sera, and that in such sera antitoxins of one or the other type are predominant, though the horses have received the same amounts of the two different toxins."

Foot-and-mouth disease in Europe, L. PANISSET (*North Amer. Vet., 2 (1921), No. 1, pp. 29, 30*).—This is a brief review of the foot-and-mouth disease situation in Europe.

Foot-and-mouth disease in Switzerland, L. PANISSET (*Rev. Gén. Méd. Vét., 30 (1921), No. 349, pp. 1–12; abs. in Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 69–71*).—"The conclusions to be drawn from the measures adopted in Switzerland against the disease are that slaughter of affected and in-contact animals is of use only when infected centers are few in number and the outbreak shows no great virulence. Sanitary measures are of value only in the same circumstances. Treatment of immediately threatened animals with the blood of recovered animals should only be adopted when the disease is very widespread. It probably reduces the gravity of the attack in animals so treated."

Crude serum treatment of foot-and-mouth disease in the Canton of Lucerne during the fall of 1920, W. ZSCHOKKE and H. ZWICKY (*Schweiz. Arch. Tierheilk., 63 (1921), No. 1, pp. 1–7*).—The authors describe in detail the method employed in Lucerne during 1920 for immunization against foot-and-mouth disease. The term crude serum is used to denote defibrinated blood. The blood is obtained from animals recently recovered from the disease, and the difficulty in obtaining sufficient blood led to the use of the entire blood of the immune animals. Milch cows about 7 or 8 years old yielded the greatest volume (from 15 to 22 liters), beef cattle the smallest (8 to 15 liters),

and steers and oxen from 10 to 22 liters. The blood, after defibrination and filtration, was mixed with 3 per cent of a 10 per cent phenol solution and the serum from at least 3 animals combined. Inoculations were made subcutaneously in both shoulders, the dose being from 300 to 450 cc. for full-grown cattle, 100 to 200 cc. for heifers and calves, 50 cc. for swine, 10 to 20 cc. for young pigs, and from 8 to 150 cc. for goats and sheep. All of the vaccinated animals were also rubbed in the mouth with saliva from sick animals.

Emergency inoculation against foot-and-mouth disease in practice and experiments with small doses of Loeffler's serum, K. SCHERN (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 50, pp. 589–595*).—Data are reported on the results of the vaccination of a large number of cattle with Loeffler's serum. Out of 1,016 healthy animals there were no losses, while of 129 manifestly sick animals with a high temperature only 8 died following vaccination.

Attempts to determine the minimum dose of Loeffler's serum led to the conclusion that while 1 cc. of the serum per hundredweight is in general sufficient, it does not protect in all cases. With young animals successful results were obtained with as small amounts as 1 or 2 cc. of the serum per animal, thus indicating that 5 cc. would suffice in all cases. It is recommended that during an epidemic of foot-and-mouth disease all the calves should receive a subcutaneous injection of 5 cc. of Loeffler's serum, followed by virus from infected animals. By such means and repeated inoculations at intervals it is considered possible to develop permanent as well as transient immunity.

Rabies, W. E. KING (*North Amer. Vet., 2 (1921), No. 2, pp. 65–68*).—This is a review of six recent papers on the subject.

Cattle plague in Belgium (*Rev. Gén. Méd. Vét., 29 (1920), No. 347, pp. 577–583; abs. in Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 76–78*).—This is a discussion of the occurrence of rinderpest in Belgium and of control measures.

Weight curves of tuberculous guinea pigs.—XX, Studies on the biochemistry and chemotherapy of tuberculosis, L. M. DEWITT (*Jour. Infect. Diseases, 27 (1920), No. 5, pp. 503–512, figs. 3*).—In continuation of the series of studies on the biochemistry and chemotherapy of tuberculosis (E. S. R., 44, p. 279), the author reports a comparison of the weight curves of normal guinea pigs with those of guinea pigs of the same age and weight at the beginning of the experiment, but which had been rendered tuberculous by inoculation with doses of tubercle bacilli.

The resulting weight curves show a fairly uniform or typical curve for the animals rendered tuberculous by inoculation of the same dose of the same strain of tubercle bacilli. This curve differs from the curve of normal animals kept under the same conditions, the alterations consisting in the main in a diminution in height of the ascending curve and an increase in length of the descending curve. It is thought that this weight curve may be used in testing the effect of various methods of treatment, as being a more reliable standard than the duration of life.

Mercury compounds in the chemotherapy of experimental tuberculosis in guinea pigs, I.—XXI, Studies on the biochemistry and chemotherapy of tuberculosis, L. M. DEWITT (*Jour. Infect. Diseases, 28 (1921), No. 2, pp. 150–169*).—In this continuation of the above series the author reports an examination of mercury compounds, mostly organic, for their effect upon experimental tuberculosis in guinea pigs.

As compared with untreated controls that had been inoculated with the same dose of the same strain of tubercle bacilli, several showed a greater duration of life and less extent of disease. In nearly all of these, however, the infection was due to a strain of low virulence, and when the same drug was

tested with a strain of high virulence no effect was in general noticed. While the results obtained were not particularly conclusive, the author is of the opinion that they justify future work with mercury compounds in the treatment of tuberculosis.

General leucocytic response of the guinea pig during the reaction of artificial immunity in experimental tuberculous infection, R. G. HUSSEY (*Jour. Expt. Med., 33 (1921), No. 3, pp. 337–348, figs. 6*).—Blood counts on guinea pigs rendered relatively immune against infection with virulent tubercle bacilli by preliminary inoculation with avirulent tubercle bacilli indicate that the immune reaction is associated with an absolute increase in the total blood count and an absolute and relative increase in the lymphocytes. While the blood counts made on animals inoculated with virulent types alone show an increase in the circulating lymphocytes during the period of greatest reaction to the infection, the blood counts on guinea pigs inoculated with virulent bacilli alone show an erratic course in which the polymorphonuclear forms are greatly but not regularly increased.

"These results indicate a parallelism between lymphoid activity and resistance of the animals to tuberculous infection, and suggest an association of lymphocytes with the factors determining this resistance, a relation which warrants consideration of the blood picture in the clinical study of tuberculous infection."

Vaccination against tuberculosis, RAPPIN (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 8, pp. 495, 496*).—Further work on preparing a vaccine against tuberculosis by the double action of sodium fluorid and antituberculosis serum on tubercle bacilli (E. S. R., 37, p. 880) is reported.

The best results are said to be obtained by allowing the bacilli to remain in the sodium fluorid for seven days and in the serum for three days. The resulting emulsion of bacilli in the serum injected into guinea pigs in doses of 0.2 to 0.3 cc., representing an initial dry weight of 0.3 to 0.4 mg. of modified bacilli, causes no tendency to suppuration and protects the animal against subsequent injection of virulent cultures sufficient to kill controls in 4, 5, or 6 months.

The influence of chaulmoogra oil on the tubercle bacillus, J. A. KOLMER, L. C. DAVIS, and R. JAGER (*Jour. Infect. Diseases, 28 (1921), No. 3, pp. 265–269*).—In contrast to the results obtained by Walker and Sweeney with the soluble sodium salts of the total fatty acids of chaulmoogra oil (E. S. R., 42, p. 777), the authors report that undiluted chaulmoogra oil and dilutions in paraffin oil had no appreciable germicidal influence in vitro on a virulent strain of bovine tubercle bacilli, as shown by subsequent growth of the treated cultures and ability to produce tuberculosis in guinea pigs. The oil injected intramuscularly in doses in 0.2 cc. per 100 gm. of body weight proved relatively nontoxic, but had no or only slight effect on the course of tuberculosis in infected guinea pigs.

The standardization of tuberculin, A. J. EAGLETON (*Lancet [London], 1921, I, No. 9, pp. 429–431, fig. 1*).—In the method outlined the usual subcutaneous test is supplemented by the von Pirquet cutaneous and the intracutaneous tests. These skin tests, particularly the former, are considered valuable adjuncts to the subcutaneous, in that fewer animals are required and the difficulty of varying sensitivity of different batches of animals is avoided. The technique for the three tests is described in detail, and data are given on the agreement and constancy of the tests.

Progress of tuberculosis eradication in Pennsylvania, S. E. BRUNER (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 32–42*).—Data on the progress of tuberculosis eradication in Pennsylvania, supplementing previous reports

(E. S. R., 44, pp. 183, 683), are presented and discussed. The author is of the opinion that infected herds can be freed of tuberculosis by two tuberculin tests if the tests are carefully applied and interpreted, the premises thoroughly cleaned and disinfected, sanitation if faulty improved, and the calves not fed on milk from doubtful sources unless it is properly pasteurized.

Affections of cattle which increase the cost of production, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 56–59*).—Attention is called to the loss caused in Porto Rico by anthrax, the cattle tick, and the horn fly.

Poisoning of cattle by Diplodia-infected maize, D. T. MITCHELL (*So. African Jour. Sci., 16 (1920), No. 5, pp. 446–452*).—It is concluded from the experiments conducted that the condition, indistinguishable clinically from that produced by feeding on infected cobs or occurring naturally in infected mealie lands, could not be set up by feeding on a culture of *Diplodia zeae* grown on sterile maize. Experiments were carried out with a view to determining whether allied species of fungi (Mucor), grown under similar conditions, would produce similar symptoms, and whether *D. zeae* grown on a cellulose medium would give rise to a similar condition where the medium was fed. All gave negative results.

Investigations as to the poisonous nature of common sorrel (Rumex acetosa) for cattle, J. F. CRAIG and D. KEHOE (*Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 27–35, fig. 1*).—Feeding experiments with *R. acetosa* conducted during the spring and summer months of 1920, and observations made in the field indicate that cattle at grass are not inclined to pick up sorrel in quantity, and do not in any way support the view that *R. acetosa* is poisonous for cattle, even when consumed in amounts that in all probability are far above those that would voluntarily be taken by grazing cattle. They afford no evidence that the oxalates present in the sorrel are in sufficient proportion to produce serious trouble in these animals.

Researches regarding epizootic abortion of cattle, J. M'FADYEAN (*Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 48–64*).—The investigations here reported have been summarized by the author as follows:

"In a herd in which epizootic abortion had been in existence for at least nine years, and which comprised 109 cows, 18 heifers in calf or recently calved, and 29 younger heifers, the disease was eradicated within a period of one year from the date of the first general test. The first general test of the herd had a positive result in 29 cases, and in at least 20 of these the agglutination titer of the serum indicated present infection (as opposed to recovery). The test was positive in every animal that had a history of abortion, and it was negative in all the heifers which had not yet been served.

"At the time of the first test the agglutination titer, when considered in connection with the known date of abortion, indicated a long persistence of the disease in a large proportion of the cases, and this was confirmed by repeated serum tests in several of the infected cows during their subsequent isolation. In 14 cows out of a total of 16 that, when heifers, had been inoculated subcutaneously with live bacilli in 1911, recovery at the date of the first general test in 1914 was indicated by an entirely negative result of a very low agglutination titer, but in the remaining two the agglutination titer indicated persisting disease.

"Agglutination tests of calves out of infected cows invariably had a positive result when made soon after birth, but a negative result or a greatly reduced titer when repeated from six months to a year afterwards."

Infectious abortion studies, B. T. SIMS and F. W. MILLER (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 532–535*).—An investigation of methods

of infectious abortion in cattle is reported briefly, with the following conclusions:

"Abortion is not necessarily preceded by shy breeding. Negative bulls which have been bred to positive cows have not spread the disease when mated with abortion-free heifers. Feeding infected milk to heifer calves has not resulted in infection of these calves. Barn, pen, and pasture exposure of abortion-free pregnant heifers to pregnant and aborting cows has resulted in a high percentage of infection and abortion. Barn, pen, and pasture exposure of mature cows has resulted in the spread of the disease. The rapidity of spread seems to have been in direct proportion to the amount of exposure."

The authors are of the opinion that abortion-free herds may be built up from abortion-infected herds by adopting methods of herd management that will prevent exposure of heifers after they reach sexual maturity.

The life history of the African sheep and cattle fluke, Fasciola gigantica, A. PORTER (*So. African Jour. Sci., 17 (1920), No. 1, pp. 126–130*).—The author presents an outline of the structure and life history of *F. gigantica*, based upon personal observations. *Limnaea natalensis*, the common pond snail, is the intermediate host.

Vaccination for blackleg in sheep, H. WELCH and H. MARSH (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 6, pp. 715–717, fig. 1*).—The authors, from the Montana Experiment Station and the Live Stock Sanitary Board Laboratories, Helena, Mont., report the successful vaccination of 6 yearling sheep with 3 cc. doses of commercial blackleg aggressin. These sheep were able to withstand the inoculation 20 days later of 5 cc. of a filtered suspension in 100 cc. of physiological salt solution of 20 gm. of finely-ground dried muscle from a calf dead of blackleg. Two controls inoculated with the virus alone succumbed to blackleg within 2 days.

The susceptibility of young pigs to hog cholera, E. M. PICKENS, M. F. WELSH, and L. J. POELMA (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 4, pp. 403–412*).—To determine the susceptibility of young pigs to hog cholera, the offspring of immune sows were tested for immunity at ages varying from 2 to 78 days by intramuscular injections in the region of the ham with 1 cc. each of hog cholera virus. The experiments were conducted on suckling pigs and on those weaned just before being exposed to the virus.

In the first series, 13 litters containing 108 pigs were used, 85 animals receiving virus alone and 23 the double treatment. With the exception of one sow which came down with the disease in 6 days and her offspring from 4 to 5 days later, none of the pigs showed visible signs of cholera. The sow which succumbed to the disease had been purchased with the history of having received a double treatment, while all the other sows had been immunized by the authors. In the experiments with pigs weaned at from 48 to 78 days, out of 45 animals the controls alone (receiving both serum and virus) did not contract the disease.

The results are thought to confirm the theory that the milk of immune sows has some influence in maintaining the immunity of suckling pigs, and to point to the advisability of immunizing pigs soon after weaning in cases of known exposure.

Method of checking hog-cholera immunity, J. F. GILLESPIE (*Vet. Med., 16 (1921), No. 4, pp. 57, 58*).—The author suggests the advisability of testing for the extent and duration of immunity to hog cholera following the serum-virus inoculation. A recommended method, if several hundred animals have been vaccinated with the same serial number of the virus, is to vaccinate with virus alone three animals from different lots at periods of from 20–30, 60–70, 90–100, and 120–140 days, respectively. Failure of the animals to contract the disease after inoculation of the virus indicates immunity at that period.

Clarified antihog-cholera serum, D. I. SKIDMORE (*North Amer. Vet., 2 (1921), No. 3, pp. 104–107*).—This contribution from the Bureau of Animal Industry, U. S. Department of Agriculture, consists of a brief explanation of the essential differences between the ordinary defibrinated antihog-cholera serum and the unconcentrated and concentrated clear serums from which the blood corpuscles have been removed. The characteristic qualities of the clear serum which render it more valuable than the ordinary serum are briefly summarized, and a table is given of the recommended dosage of the different products. The same doses are recommended for ordinary defibrinated blood serum and unconcentrated clear serum, while the doses of the concentrated clear serum are on an averge 25 per cent larger.

Investigation of the occurrence of paratyphoid bacilli in horses and their connection with infectious abortion of mares, GMINDER (*Arb. Reichsgsndtsamt., 52 (1920), No. 1, pp. 113–132*).—From material obtained from 44 cases of abortion in mares, the author has isolated an organism belonging to the paratyphoid enteritis group resembling *Bacillus paratyphosus* rather than the typical Gärtner *B. enteritidis.* In the serum of mares which had aborted, specific antibodies against this organism were found through agglutination and often through complement fixation tests. In experimental animals (white mice and rats) abortions were brought about by intravenous, intraperitoneal, and subcutaneous inoculations of pure cultures of the organism and also by feeding the cultures.

The control of infectious abortion in mares, E. S. GOOD (*Vet. Med., 16 (1921), No. 3, pp. 23, 24*).—The author describes the work which has been done at the Kentucky Experiment Station in the study and control of infectious abortion in mares.

From 15 studs of aborting mares in the blue grass region an organism (*Bacillus abortivo-equinus*) belonging to subgroup 2 of the colon typhoid group has been isolated. Abortions have been induced by intravenous injections of massive doses of this organism and also by feeding the organism.

Field results in the use of a vaccine for controlling abortion have been encouraging. The vaccine is prepared by streaking an agar slant having a surface of about 1.75 by 9 cm. with a culture of the organism. The culture is incubated for 24 hours, washed with 10 cc. of normal salt solution into a sterile bottle containing sterile glass beads, and filtered through sterile flannel. The material is then heated in a water bath at 70° C. for 2 hours, after which 5 standard loopfuls are streaked and cultured on agar to determine sterility. One cc. of the final vaccine, to which 0.5 per cent of phenol is added for preservative purposes. contains about 8,500,000,000 organisms. The method at present used for immunization consists in 4 subcutaneous injections at 8-day intervals of 1, 2, 3, and 4 cc., respectively, the last dose being of double strength vaccine.

This inoculation is thought sufficient to immunize mares until the foaling season has passed, but should be repeated each year as a prophylactic measure. It is reported that mares in one herd in which abortion was stopped by vaccination in 1916 have been vaccinated yearly ever since without a single case of abortion.

Cirrhosis of the liver in the horse, J. F. CRAIG and D. KEHOE (*Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 35–47, figs. 4*).—This account draws attention to the presence of an affection in one part of Ireland which has a great similarity to Schweinsberger disease, dunziekte, and poisoning by ragwort.

The treatment of joint-ill in foals with the dam's blood, G. FORSSELL (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 6, pp. 663–675*).—The author

describes in detail the method of treating joint-ill in foals with blood from the dam (E. S. R., 42, p. 382), and gives a large number of case reports of the successful use of this treatment. Brief abstracts are included of reports from recent German literature on the subject. Out of 157 cases mentioned 127 were treated with success, while the remaining 30 foals died. As possible reasons for these failures, the author suggests the application of the treatment too late in the disease, failure to give sufficient serum, failure on the part of certain dams to produce sufficient antibodies, and the possibilty of common navel infection other than true joint-ill.

Control of poultry lice and mites, W. F. SCHOPPE (*Montana Sta. Circ. 95 (1921), pp. 8, figs. 2*).—A popular account dealing with the poultry mite, *Dermanyssus gallinae;* the poultry louse, *Menopon pallidum;* and scaly leg mite (*Dermatoryctes, Sarcoptes*) *Knemidocoptes mutans.*

RURAL ENGINEERING.

Irrigation in Montana, D. BOYLE ET AL. (*Helena: Mont. Irrig. Comn., 1920, pp. 96, figs. 12*).—This is the annual report of the Montana Irrigation Commission, which is intended to cover present development and future possibilities of irrigation in Montana. The report takes up first general information dealing with the origin and organization of the commission, the need of a State irrigation survey, the feasibility of pumping projects, and reservoir and irrigation statistics, including a summary of the findings and an estimate of the ultimate irrigation possibilities of the State. This is followed by a complete description of the 15 irrigation projects, and also a brief outline of contemplated projects. The rest of the report takes up in order a descriptive summary of all the Carey Act projects in the State, the U. S. Reclamation and Indian Service projects, and a short write-up of the irrigation in each county separately.

Report of the State irrigation commissioner, G. S. KNAPP (*Kans. State Irrig. Commr. Rpt., 1919–20, pp. 28, pl. 1*).—A brief résumé of the work and financial transactions of the office of the State Irrigation Commissioner of Kansas for the period from June 16, 1919, to June 30, 1920, is given. It includes among other things a discussion of the State irrigation laws and suggested improvements therein and of irrigation plants installed by the State.

Pump irrigation (*Nebraska Sta. Rpt. 1920, p. 23*).—Studies to determine the cost of irrigation water under a pumping system where water is lifted 40 ft. by a 6-in. rotary pump, driven by a 30 h. p. kerosene engine, to irrigate corn, alfalfa, and potatoes showed that 153.75 hours of pumping, giving 317.09 acre-inches of water, or 8,494,650 gal., were required to irrigate 48 acres. A total of 640 gal. of fuel was used, with an approximate fuel cost of 40 cts. per acre-inch of water pumped from an average depth of nearly 40 ft.

Action of water containing chlorids on cereals, D. N. GUGLIELMETTI (*Rev. Facult. Agron. y Vet., La Plata, 2. ser., 14 (1919), No. 1, pp. 75–83, pls. 8*).—Experiments with wheat, oats, barley, and rye are reported, which showed that irrigation with water containing as high as three parts per thousand of sodium chlorid did not injure these cereals. Where the soil is underlaid by an impervious subsoil there is danger, however, of a sufficient accumulation of soluble salts to cause sterility.

Rainfall and run-off in the Miami Valley, I. E. HOUK (*Miami [Ohio] Conserv. Dist., Tech. Rpts., pt. 8 (1921), pp. 234, pls. 9, figs. 42*).—The purpose of this report is to present to the engineering profession the results of rainfall and run-off investigations carried on in connection with the Miami flood control project.

Application of the law of variables to the design of drainage outlets, D. P. WEEKS (*Agr. Engin., 2 (1921), No. 4, pp. 81–84, figs. 4*).—The law of variables is analyzed, with particular reference to its possible application in the design of drainage systems, and a research project is outlined which includes the grouping and study of different types of drainage districts according to their characteristics and the application of the law of variables to the data obtained.

Proceedings of the tenth annual drainage convention held at Washington, N. C., March 31 and April 1, 1920 (*N. C. Geol. and Econ. Survey, Econ. Paper 50 (1920), pp. 78, pl. 1*).—These proceedings contain special papers on The Relation of Food Control to Drainage, by T. Saville; Some Drainage Problems in the "Great Swamp Area" of North Carolina, by H. M. Lynde; Tile Drainage of Flat Lands, by F. O. Bartell; Piedmont Drainage in North Carolina, by W. D. Alexander; Drainage Projects, by P. Matthews; Maintenance of Drainage Ditches, by W. K. Allen; and Drainage Assessments in North Carolina, by G. R. Boyd.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 3, pp. 23, figs. 19*).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in May, 1921, together with status of Federal aid as of May 31, and the following articles:

The Story of One Gravel Road, by B. E. Gray; The Traffic Census and Its Use in Deciding Road Width, by A. N. Johnson; Unusual Drainage Conditions in Public Roads District No. 12, by E. E. Kidder and A. B. Brown; Pennsylvania Commissioner Urges Economy; The Patrol System a Success in Grant County, Wash., by A. F. Morris; and Tests for Subgrade Soils, by A. T. Goldbeck and F. H. Jackson (see below).

Tests for subgrade soils, A. T. GOLDBECK and F. H. JACKSON (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 3, pp. 15–21, figs. 7*).—An outline of methods of testing subgrade soils is given in this paper, together with the general results of some of the tests. The tests are for such physical properties of subgrade soils as gradation, water-holding capacity, moisture equivalent, vertical capillarity, air shrinkage, slaking time, cementing value, percentage of colloidal material, as determined by adsorption, and relative bearing power of the soil under various conditions of density and moisture content.

It has been found that the determination which apparently yields the greatest amount of information is the test for moisture equivalent. Results of tests so far would indicate that in general moisture equivalents increase with the percentage of very fine silt and clay in the soil. It has been possible to work out an empirical formula which indicates a fairly definite relation between the moisture equivalent and mechanical analysis. There are sufficient exceptions, however, to indicate that certain other factors, possibly percentage of loam, etc., influence this relation.

Results of the tests would indicate also that the bearing power of most soils is not appreciably reduced by the addition of moisture up to the moisture equivalent. This apparently applies, moreover, to all types of soils from pure sand to heavy clays. When the soils become saturated beyond the moisture equivalent, however, a rapid reduction apparently takes place in bearing power, which usually disappears completely at or before the water-holding capacity of the soil has been reached.

A study of the California highway system by the United States Bureau of Public Roads ([*Sacramento*]: *Calif. Highway Comn. and Highway Engin., (1920), pp. 277, figs. 185*).—This report gives the details of a study made to determine the operations under the three California State highway bond issues and the costs thereof, the present condition of the roads built and so far as

possible the costs of existing conditions, and also to determine a measure of the usefulness and duty of the highway system and to develop recommendations for the future.

The principal operation was to classify all the pavement laid. This classification covered 1,262 miles, from which a complete record of conditions of all concrete pavement for each 1/10 mile resulted. In addition studies were made of cores cut through pavements, failed portions of road surfaces, soil moisture conditions, subgrades, and traffic.

Eighth biennial report of the State Highway Department relative to highway improvement, F. E. EVERETT (*N. H. State Highway Dept. Bien. Rpt., 8 (1919–20), pp. 243, pls. 8, fig. 1*).—Data are reported and discussed on the work and expenditures of the State Highway Department of New Hampshire for the period from August 31, 1918, to August 31, 1920.

Eleventh biennial report of the State highway commissioner of the State of Vermont for the two years ending June 30, 1920, S. B. BATES (*Vt. State Highway Commr. Bien. Rpt., 11 (1919–20), pp. 42*).—This report gives the text of the law of Vermont affecting the highway funds expended under the supervision of the State Highway Department, and reports the expenditures on highway work in the State during the calendar years 1918 and 1919. Expenditures under special appropriations and special provisions of the law are given for the biennium ended June 30, 1920.

Palm oil motors, R. MAYNÉ (*Ann. Gembloux, 26 (1920), No. 11, pp. 509–515*).—Analyses of samples of palm oil for use in internal-combustion engines are given and discussed.

This oil is extracted from the pulp of palms and palm fruit, and consists of a mixture of palmitate and oleate of glycerin with acid in variable proportions. It is yellow or red in color and of a buttery consistency at ordinary temperatures. The analyses show that the melting point of palm oil is from 37 to 48° C. (98.6 to 118.4° F.), so that its practical use as a fuel is apparently limited to torrid climates unless artificial means of preheating are provided. A calorific value of 9,228 calories is given. Data are given showing that the production of palm oil in different parts of West Africa is quite extensive.

Preliminary tests of this fuel, especially in semi-Diesel engines, have shown that complete combustion is assured by vaporization of the fuel and injection in quantity strictly proportional to the load. The composition of the gaseous mixture should be constant, which condition is obtained by the injection of an amount of water proportional to the load and to the amount of fuel injected. The scavenging of burned gases should be very effective.

Palm oil is shown to have a flash point of about 187° and a burning point of about 210°.

Dilution of engine lubricants by fuel, G. A. KRAMER (*Jour. Soc. Automotive Engin., 6 (1920), No. 2, pp. 123–128, figs. 13*).—Experiments conducted at the U. S. Bureau of Standards to determine to what extent fuel evaporation can occur at average engine temperatures, with particular reference to tractor engines, are reported.

It was found that the absorption of fuel vapors at engine temperatures is negligible. While the data are not final, dilution due to cracking was not found to any considerable extent in used lubricating oils. Studies of separation of fuel from lubricating oils indicate that there is no necessity for highly developed distillation methods when the present-day commercial engine gasoline or a more volatile fuel is to be removed from lubricating oils. In this connection it was found that the time of heating and the exposed area of oil surface have very marked effects on the removal of fuel from oil.

Tractors and cable tractors, M. P. KREUTZBERGER (*Bul. Off. Dir. Recherches Sci. et Indus. et Invent., No. 16 (1921), pp. 90–115, figs. 13*).—An analysis is given of the agricultural work of tractors and cable tractors from the French viewpoint, and it is concluded that the cable tractor is of more general usefulness than the simple tractor. An analysis is also given of the construction, operation, and work of cable tractors, and it is shown that the cable tractor with traction parallel to the longitudinal axis has a greater field of usefulness than the one with traction at right angles to the longitudinal axis.

Results given in Belgium by tractors, E. LEPLAE (*Jour. Soc. Natl. Agr. Belg., 3 (1921), No. 7, pp. 49–53*).—The results of a survey of the work of tractors on 67 Belgium farms, varying in size from 75 to 1,250 acres, are reported. Of these 48 varied in size from 125 to 500 acres. Forty-two out of 45 tractor owners seemed satisfied with the tractor as a source of farm power.

The soils on the farms varied from sandy loam to heavy clay. Plowing was the principal work of the tractor on these farms, the depth varying from 6 to 10 in. It was found that the average tractor will plow from 2.5 to 7.5 acres per 10-hour day, according to the depth and type of soil. It was also possible to cultivate from 7 to 20 acres per day, disk from 10 to 30 acres, roll from 12½ to 25 acres, harrow from 12½ to 50 acres, harvest from 7½ to 17½ acres of grain, mow 7½ acres of hay, and thrash from 120 to 200 sacks of grain.

Of 47 tractors, 15 used kerosene and 32 gasoline as fuel. It was found that when plowing 8 in. deep on loam soil at the rate of about 6¼ acres per day the consumption of gasoline was from 3.2 to 3.7 gal. per acre. On heavy loam or clay soil the gasoline consumption was from 3.7 to 4.3 gal. per acre when plowing at the rate of about 5 acres per day. The consumption of kerosene was a little less than that of gasoline, the difference never exceeding a half gallon per acre. The consumption of lubricating oil varied from 2 to 5 qts. per day.

More than half of the tractor owners employed an ordinary farm hand to operate the tractor, and the remainder employed either trained mechanics or operated the tractor themselves. As to accomplishment, it was found that 1 tractor will plow about 5 acres per day, while 1 man and a 3-horse team will plow a little over an acre per day to the same depth, or a tractor and 1 man will replace on plowing 5 men and 15 horses. The tractor supplants from 4 to 9 horses and from 9 to 12 oxen, depending on the size of the farm.

The main advantage of the tractor recognized by the Belgian farmer is the quickness of execution of farm work, and the majority reporting were satisfied with the quality of the work. The main disadvantages of tractors noted are high purchase price, heavy expense of repair parts, fuel, and lubricant, complicated mechanism, rapid depreciation, difficulty of obtaining skilled operators, and difficulty of use during wet weather.

Working tests with motor plows in fall of 1919, A. CHRISTENSEN (*Statens Redsk. Prover, Beret. 23 (1920), pp. 103, figs. 16*).—Comparative field and laboratory tests of 18 different commercial makes of tractors and tractor plowing outfits are reported and discussed. Twelve of these were of American make.

The lowest fuel consumption on actual plowing was given by a tractor having a 4-cylinder, 4-stroke cycle motor, and rated at about 15 drawbar horsepower. This tractor drew a 2- and 3-bottom plow to a depth of 7 in. at a speed of about 2.2 miles per hour, and plowed furrows 28 and 33 in. wide, respectively. The highest fuel consumption per unit area plowed was given by a 4-cylinder, 4-stroke cycle motor rated at 16 drawbar horsepower, which drew two plows to a depth of 7 in. and cut a furrow 26 in. wide.

Practical tests of mechanical cultivation at Bourges, LAVERDET (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul. 24 (1920), No. 102, pp. 284–292*).—

Plowing tests of 31 different motor-propelled plowing outfits on siliceous clay soil are briefly reported and discussed.

The outfits included 23 ordinary tractors, 4 caterpillar tread tractors, 2 automobile plows, and 2 motor cultivators. Each outfit plowed 1 hectare (2.47 acres) of soil. The detailed data of the tests are given in tabular form, showing width, depth, and speed of plowing, area plowed per hour, total fuel consumption, and fuel consumption per unit area plowed. The smallest fuel consumption per unit of area plowed was indicated by an 18 h. p. ordinary tractor, drawing a 2-bottom plow to a depth of 18 cm. (7 in.). The greatest area was plowed in 10 hours by a 45 h. p. caterpillar tractor, drawing a 6-bottom plow to a depth of 13 cm., and with a fuel consumption per unit area somewhat less than the average.

Tractors and their utilization in the cultivation of sugar cane in Porto Rico, Brebner (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 43–51*).—General information on the use of tractors for the cultivation of sugar cane in Porto Rico is presented, special attention being given to the caterpillar type.

Factors influencing the draft of plows, E. V. Collins (*Agr. Engin., 2 (1921), No. 2, pp. 27–29, figs. 8*).—Experiments conducted at the Iowa Experiment Station, to compare the draft of various types of plow bottoms as affected by speed and to determine the power required to cut the furrow slice as compared to the power required for turning and pulverization, are reported. In addition tests were made to determine the effect of the varying of the depth of plowing and the effect of dull shares.

The equipment used was a No. 11 sulky plow with stubble, general-purpose, breaker, slat, and No. 222 bottoms, and a tractor plow with stubble, general-purpose, and speed bottoms. It was found that the type of plow bottom does not materially affect the draft, and that an increase in speed will produce about the same increase in draft with any type of bottom. The increase in draft due to speed was found to be confined to that part of the total which is required for turning and pulverizing. This varied with the speed from less than one-third to about one-half the total draft of the plow within a speed range of from 2 to 4 miles per hour.

Variation in depth is considered to be probably the greatest source of error in plow tests of a comparative nature. Under some conditions of plowing a sharp cutting edge was found to be of little importance, but it is concluded that under certain conditions it may cause failure to scour.

Mechanical cultivation of rice (*Meded. Deli Proefsta. Medan, 2. ser., No. 16 (1920), pp. 5*).—Data on plowing, disking, and harrowing of rice soils with a tractor are summarized. While the actual cost per acre plowed is slightly less for oxen than for the tractor, the advantage of mechanical over hand cultivation is very evident in the smaller number of men employed.

A serviceable farm barn, R. L. Patty and C. Larsen (*S. Dak. Agr. Col. Ext. Circ. 32 (1920), pp. 20, figs. 12*).—Plan and elevation drawings, specifications, and a bill of materials for a general barn suitable for a South Dakota farm of from 160 to 320 acres are presented and discussed in the first part of this bulletin. The structure consists of a main barn, shed, silo, and feeding room. The second part of the bulletin is a discussion of the important features in barn planning, particularly dairy barns.

Dairy barn plans, J. L. Thomas (*Tex. Agr. Col. Ext. Bul. 59 (1921), pp. 20, figs. 27*).—Plan and elevation drawings and bills of material are given for dairy barns and milk houses adapted to Texas conditions.

Housing of animals.—III, Sheepfolds and hog pens, M. Ringelmann (*Logements des Animaux.—III, Bergeries, Porcheries. Paris: Libr. Agr.*

Maison Rustique, 1920, pp. 160, figs. 127).—This book describes French practice in the design and construction of sheepfolds and hog pens and houses with their accessories. In the first part chapters are included on the location of sheepfolds, mangers and feeding racks, watering devices, doors and windows, shearing machines and dipping tanks, types of sheepfolds, permanent shelters, and sheep runs. The second part contains chapters on the location of hog pens, feeding troughs, and hog houses; the construction of hog pens, automatic rubbers, dipping tanks, and slaughter houses; and types of hog houses and pens. A number of diagrammatic illustrations are included.

Rural refrigerating plants for the conservation of fruit, F. Mauro (*R. Scuola Super. Agr. Staz. Sper. Freddo, Milan, No. 1 (1920), pp. 15, pls. 7.*—Plan and elevation drawings of two farm refrigerating plants are given and the general features of the refrigeration apparatus discussed.

Studies on the treatment and disposal of industrial wastes.—IV, The purification of creamery wastes, H. B. Hommon (*Pub. Health Serv. U. S., Pub. Health Bul. 109 (1920), pp. 87, pls. 5*)—A study is reported which was undertaken by the U. S. Public Health Service in cooperation with the U. S. Department of Agriculture for the purpose of developing a method for purifying creamery wastes. In the course of this study it was found that methods already in use were efficient and practical in only a very few instances, and very unsatisfactory in a large number of other installations.

The raw waste treated in the experimental testing stations was produced from the manufacture of butter cottage cheese, casein, and condensed milk, and was very concentrated. The original plans for the testing station included an Imhoff tank and a septic tank, but difficulties were encountered in operating the Imhoff tank which finally led to its abandonment. The septic tank was operated for about two years. A comparison of the weighted average analyses of the influent and effluent for the entire time the tank was operated showed that 40 per cent of the suspended matter in the raw waste was deposited in the tank. The septic tank did not accomplish as high a removal of the various constituents of the raw waste as was expected. It was not provided with a tight cover at the beginning of the tests, but this became necessary during the spring following the first winter. This experience suggests the necessity of locating septic tanks and filters as far away as possible from the creamery or from dwellings and other buildings.

Sand filters were used for treating the effluent from the septic tank. The effective size of the sand used was 0.23 mm. and the uniformity coefficient was 2.17. It was found that the essential features that should be considered in designing sand filters for treating creamery wastes are as follows: (1) The underdrainage should be carefully laid with ample slope to the bottom and covered with coarse and fine stones to prevent the entrance of sand; (2) the sand selected should be of medium size and free of clay and loam; (3) the filter units should be arranged to provide for a number of doses; (4) filter beds should be divided into at least two units so that one can be taken out of service for the purpose of resting or repairs; and (5) unless the treatment plan is to be under constant and competent supervision the filter should be designed to treat the waste at a rate not to exceed 50,000 gal. per acre per day.

Observation of the sludge showed that there was an average deposition of 2 tons of dry solids per 1,000,000 gal. of waste passing through the tank. Chemical analysis showed that it contained no valuable by-products, and that it had no high-grade fertilizer value. It was found that pumping will be required where the difference in elevation between the discharge of the waste to the disposal site and the outlet into the water course is less than 7 ft. A centrifugal pump and automatic control device are recommended for this purpose.

The detention period of 24 hours was not found sufficient to remove as large a part of the suspended matter as is believed could be accomplished. It is recommended, therefore, that tanks designed for creamery or like wastes be computed on a storage basis of 48 hours with 30 per cent additional for scum and sludge accumulation. The tank should be divided into two sections separated by a concrete wall, with 2-in. holes through it at mid depth of the waste. The inlet section should have a capacity of two-thirds of the volume of the entire tank and the outlet section one-third. The inlet section should contain at least three baffles, one 1 ft. from the inlet pipe and extending from above the surface of the waste to 3 ft. below, one 1 ft. in front of the outlet and conforming to the one before the inlet, and one in the center of the tank extending up one-half the distance from the top of the hopper bottom to the flow line of the tank. The hopper bottoms should have a slope of 60°, and the sludge outlet should be 6 in. in diameter. The inlet and outlet pipes to and from the tank should be turned down and trapped. It is recommended that a siphon be installed in connection with the disposal tank, and that the siphon chamber be so designed as to discharge enough waste each time to cover the sand filter to a depth of ½ in.

A large amount of experimental data is given in tabular form, together with a bibliography.

Substitutes for sewers, W. A. HARDENBERGH (*Pub. Works, 50 (1921), Nos. 15, pp. 293–296; 17, 358, 359, figs. 10*).—Substitutes for sewers in common use in suburban districts, towns, villages, and rural communities are discussed. The methods most generally used are classified as temporary arrangements, such as the pit, box, and can; semipermanent arrangements, such as concrete vaults and modifications and septic closets; and permanent arrangements, such as chemical closets and small septic tank systems with running water.

A comparison of the first and annual costs of a 10-year period, maintenance and operating expenses of the different more common types is given in the following table in order to show their relative expense:

Approximate cost of sewer substitutes on a 10-year basis.

Type of disposal.	Installation.	Interest and maintenance.	Scavenging.	Total cost.	Annual cost.
Pit	$60.00	$19.80	$36.00	$115.80	$11.58
Box (wood) and can	24.00	10.02	70.00	104.02	10.40
Concrete vault	35.00	21.00	60.00	116.00	11.60
Commercial L. R. S	38.50	23.10	20.00	81.60	8.16
Home-made L. R. S	35.00	21.00	20.00	76.00	7.60
Chemical toilets	65.00	39.00	50.00	154.00	15.40

Does not include share of disposal expense, as purchasing land for burial, etc.

RURAL ECONOMICS AND SOCIOLOGY.

Rural social organization, E. L. EARP (*New York: Abingdon Press, 1921, pp. 144*).—Briefly and in outline form attention is called to some of the fundamental social and economic principles underlying rural organization, as well as methods of organizing and the social functions of the rural home, school, church and Sunday school, and farmers' organizations. The effects of tenancy, good roads, and adequate marketing facilities, together with the rural health situation, are similarly treated.

The southern highlander and his homeland, J. C. CAMPBELL (*New York: Russell Sage Found., 1921, pp. XXII+405, pls. 70*).—In observations after the author's 25 years' experience as teacher and investigator in mountain sections

of the South, this volume describes the topography of a region embracing the western border counties of Maryland, Virginia, and North and South Carolina, the Blue Ridge Valley, all of West Virginia, eastern Tennessee and Kentucky, northern Georgia, and northeastern Alabama, as well as the people who dwell there and incidental history accounting for their ancestry, speech, and customs. Various expressions of the individualism characteristic of the highlander are cited, and the home life, religious life and denominationalism, and living conditions and health of these people, as well as the resources of the mountain country and the problem of education, are discussed. There are pointed out in conclusion certain avenues for contact and progress. It is urged that the new appeal for support of schools and churches for the southern mountaineers be made on the basis of real knowledge of conditions and changing needs, determined by the survey method.

Appendixes give regional descriptions of State mountain areas, quotations from the theory of J. Fiske as to the origin of these people, which the author calls a misapplied one, a list of markers on Boone's trail, historical estimates on the Scotch-Irish and Germans in 1775, and several summary statistical tables. A bibliography of about 260 titles is included.

Rural and small community recreation (*New York: Community Service, 1921, pp. 152*).—This booklet offers a compilation of practical material relating to the social and recreational features of rural life, describing numerous games, and suggesting exhibits, contests, and community programs.

The farming of national land, Lord Ernle (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 121–129*).—A number of what the author calls obvious difficulties raised by a proposed bill to abolish private property in land in Great Britain and to make it national property are dealt with. The bill is explained in outline, and benefits claimed for the plan are set forth.

Land settlement in Scotland, H. M. Conacher (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 175–186*).—Conditions in the crofting counties and islands off the coast of Scotland and the efforts to satisfy demands for more holdings in relief of congestion in various districts are described. A sort of social equilibrium is said to exist in other parts of Scotland where large arable farms have been developed, but certain efforts toward the establishment of small holdings in those regions also are noted.

Farm tenantry in the United States, W. B. Bizzell (*Texas Sta. Bul. 278 (1921), pp. 3–408*).—This thesis is a study of the historical development of farm tenancy and its economic and social consequences on rural welfare, with special reference to conditions in the south and southwest of the United States. The writings of early land reformers and economists of the eighteenth and nineteenth centuries, in this connection, are reviewed in some detail. It is pointed out that while early colonial efforts to transplant the manorial system of England in this country largely failed, the adoption of the legal system from England has resulted in economic handicaps to the tenant farmers here. Inadequate labor income, speculation in land values, and the high rates of interest charged to the tenant are said to be mainly responsible for the farm tenancy problem. The low average standards of living, lack of interest in church and Sunday school, neglect of reading, political prejudices, and general disinterest in community welfare are said to reflect the prevailing system of land tenure. Methods of encouraging and assisting farm tenants to purchase homes and secure social justice in negotiations with landlords are suggested.

An extensive bibliography is appended.

Farm rent contracts as affected by the Regent's decree of June 30, 1918, C. Papi (*Atti R. Accad. Georg. [Florence], 5. ser., 16 (1919), No. 1, pp. 8–37; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.,*

10 (1919), No. 10–12, pp. 1236–1241).—This is a commentary on recent Italian legislation distributing the extra profit resulting from the war between the proprietor, farmer, and tenant.

An ordinance relating to a preliminary agricultural labor law of January 24, 1919, together with several regulations on the question of the rights of agricultural laborers, J. FEIG (*Verordnung Betreffend eine Vorläufige Landarbeitsordnung vom 24. Januar, 1919, nebst Sonstigen Bestimmungen über das Landwirtschaftliche Arbeitsrecht. Berlin: Franz Vahlen, 1919, 2. ed., pp. 122*).—The text is given of a 1919 law regulating rates of wages and hours of working for Germany, and of other similar legislation.

First International Congress of Landworkers' Unions affiliated to the International Federation of Trade Unions (*Internatl. Labor Off., Geneva, Studies and Rpts., Ser. K, No. 1 (1920), pp. 11*).—This reports the organization, membership, and work of this congress, held in Amsterdam, August 17 to 19, 1920.

Kansas handbook of harvest labor, H. UMBERGER and E. L. RHOADES (*Kans. Agr. Col. Ext. Circ. 23 (1921), pp. [16], figs. 7*).—Information is offered here in regard to the demand for, sources of supply and methods of recruiting, wages, and working hours of wheat harvesters in Kansas.

Wages of farm workers in 1920–21, J. WILSON (*Scot. Jour. Agr., 4 (1921), No. 2, pp. 186–199*).—Returns from 66 farms in different parts of Berwickshire, England, and from 32 in Bute and Arran, Scotland, are tabulated and discussed to show the earnings of different classes of farm workers during the year commencing with Whitsunday, 1920, with comparisons.

Agricultural profits and the contribution of agriculture to the national income, A. DE MARCILLAC (*Cong. Agr. Franç., 1920, Compt. Rend. Trav., pp. 111–142*).—These pages give a critical discussion of tax rates on agricultural industries and rural property in France, in which it is held that it would be less practicable to increase the already exorbitant tax rates than to foster more profitable returns from agricultural enterprises.

The farmer and the tariff, H. C. WALLACE (*Wallace's Farmer, 46 (1921), No. 14, p. 617*).—Arguments are presented in favor of the protection of practically all agricultural products against foreign competition. It is said also that such protective duties must cover present extraordinary freight charges.

Farmers' cooperative associations: Their legal and legislative aspects, A. HOBSON (*Amer. Econ. Rev., 11 (1921), No. 2, pp. 221–226*).—Objections are made to Section 6 of the Clayton Amendment from the point of view that the status of farmers' organizations is made more indefinite and uncertain than before, as well as that of economic difficulties of organization which are involved. Proposed legislation and accomplishments expected of it are outlined. Reasons are given why this is deemed not to be class legislation, but rather that which will insure farmers' marketing associations certain privileges enjoyed by business corporations.

The organization and activity of the Italian Federation of Agricultural Societies (*Rome: Fed. Ital. Consorzi Agr., 1920, pp. [19], pls. 6*).—This recounts the history of this organiaztion and describes its various activities.

Report on the working of cooperative societies in Bihar and Orissa for the year 1919–20 (*Bihar and Orissa Coop. Socs. Rpt., 1919–20, pp. [VI]+19+XIX+2, pl. 1*).—This continues information regarding the enterprise previously noted (E. S. R., 42, p. 594).

Marketing of agricultural products, J. E. BOYLE (*Amer. Econ. Rev., 11 (1921), No. 2, pp. 207–213*).—Five related steps in the marketing process, namely, production and grading for the market, storage, transportation, means of obtaining credit and its use, and merchandising are briefly discussed from

the point of view of what the farmers may do to improve and control marketing processes.

Criteria of marketing efficiency, F. E. CLARK (*Amer. Econ. Rev., 11 (1921), No. 2, pp. 214–220*).—These criteria are said to be the effectiveness with which the distributive serice is rendered, its cost, and the effect of the cost and methods upon production and consumption. The first two are held to involve problems of mechanical as well as trade or bargaining efficiency, the last the use of standard grades, security of a "just share" of the final selling price, market competition, transportation rates, finance and warehouse methods, and the creation of demand. Governmental assistance and private cooperation can avail to improve market news, control production, improve the physical efficiency of central markets, improve transportation rates and efficiency, increase the standardization and grading of products, and control excessive profits.

Future trading (*U. S. House Represent., 66. Cong., 3. Sess., Com. Agr. Hearings on Future Trading, 1921, pp. 1070, fig. 1*).—The statements of 81 individuals made in January and February, 1921, before the committee conducting hearings relating to legislation bearing on future trading are published here.

State ownership of terminal elevators, flour mills, and packing plants, D. LIVINGSTON (*Pierre, S. Dak.: Marketing Dept., 1920, pp. 24, pl. 1*).—In this preliminary report the author concludes that present building conditions are such as to justify a postponement of the erection by the State of elevators, flour mills, and packing plants until prices of material settle and labor conditions improve; also that it would be unwise to erect plants in relation to present marketing outlets, in view of the fact that the proposed all-water route from the Great Lakes to the Atlantic may change the whole situation within three or four years. For several other reasons it is recommended that the State urge Federal legislation rather than attempt to meet the problem by isolated action.

The grain marketing plan of the Farmers' Marketing Committee of Seventeen, C. H. GUSTAFSON ET AL. (*Chicago: Farmers' Grain Marketing Com. of Seventeen, 1921, pp. 16, fig. 1*).—In this outlined explanation of the proposed plan, the three fundamental elements of the system are said to be the grain grower, the local cooperative elevator company or grain growers' association, and the central sales association. The grain grower, in becoming a member of the organization, joins the national sales association, paying a fee for permanent membership, and signs a contract to deliver all of his surplus grain to the local elevator company or grain growers' association for a period of probably five years. The surplus grain of the members may be handled by the local organization or may be pooled. Where there is no local cooperative elevator company, or in case it does not meet requirements, the local association may either contract with a farmers' private or line elevator to receive and load its grain at a handling charge mutually agreed upon, rent an elevator, or build or buy one. The relations of the local body to the central sales association are outlined, together with stipulations as to the election of a board of directors, its departmental organization, and subsidiary companies. A series of questions and answers about the plan are given.

Grain marketing plan of the Committee of Seventeen (*Chicago: U. S. Grain Growers, Inc., 1921, pp. 56*).—Information is given similar to and supplementing that noted above.

Grain standardization, H. B. PRICE (*Amer. Econ. Rev., 11 (1921), No. 2, pp. 227–230*).—The early history of the setting up of grade standards by grain exchanges, the broadening of control of inspection, and some criticisms of the system evolved are set forth.

Cost of fattening cattle and the relation of the enterprise to the farm business (*Nebraska Sta. Rpt. 1920, p. 27*).—Studies of factors entering into the cost of feeding cattle were conducted on 75 neighboring farms in northeastern Nebraska.

During the winter of 1919–20 only about one-third of the feeders were found to be making money, the other two-thirds losing enough to make the average loss $10.63 a head on the 3,041 cattle included in the survey. Only 12 per cent of the 795 cattle on the detailed cost route made any profit.

The work of the council of agriculture for the Province of Pomerania, REICHERT (*Kriegsarbeit der Landwirtschaftskammer für die Provinz Pommern. [Pomerania]: Pommernblattes, 1914–1918, pp. 106, figs. 6*).—An account is given of measures adopted to promote agriculture, live-stock production, and other rural industries during the war and of results accomplished.

Southern Anatolia, C. MANETTI (*Agr. Colon. [Italy], 15 (1921), Nos. 1, pp. 41–49, pl. 1; 2, pp. 78–111, pls. 2; 3, pp. 142–158*).—These chapters of a series of articles descriptive of this region relate mainly to systems of land holding and tenancy and of farming, the principal crops, labor supply, tools and implements used, typical dwellings and farm buildings, care of farm animals, and the importance attached to live-stock production.

French colonial agriculture (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 1, pp. 103–173*).—Several papers covering problems of agricultural development in the French colonies are published here, as follows: Banks and Colonial Agriculture: Agricultural Credit for the Colonies, by E. Hecht (pp. 103–137), in which outstanding features of the various banking organizations in operation in old and new French colonies, as well as those belonging to other nations, are outlined; Loans to Natives in Cochin China, by Paris (pp. 138–142), noting the dissolution of certain German credit societies following the outbreak of the war and legislation under which new ones can be organized: The Colonization of the New Hebrides, by Largeau (pp. 143–156), describing the geography, resources, labor supply, administration, and reforms needed in this region; and Some General Considerations pertaining to Agriculture and Commerce of Upper Senegal, by J. Raffin (pp. 157–173).

[Agriculture in Dutch East Indies] (*Netherlands East Indies Yearbook, 1920 (Eng. ed.), pp. 109–116, pls. 3*).—This chapter offers brief notes descriptive of the principal crops grown and the agricultural information service designed to promote production, cooperation, and community life through demonstration and technical instruction and aid.

[Agricultural statistics of Peru] (*Peru Statis. Abs., 1919, pp. 51–61*).—These statistical tables show the area cultivated and yields by departments for several years of several important crops, mainly sugar cane, rice, cotton, and wheat, also the production of guano for domestic agriculture, 1900–1919.

Returns of produce of crops in England and Wales, with summaries for the United Kingdom, R. J. THOMPSON (*Min. Agr. and Fisheries [London], Agr. Statis., 55 (1920), No. 2, pp. 89*).—These tables continue the statistical series previously noted (E. S. R., 43, p. 491).

Prices and supplies of corn, live stock, and other agricultural produce in England and Wales, and summaries of colonial and foreign agricultural statistics, R. J. THOMPSON (*Min. Agr. and Fisheries [London], Agr. Statis., 55 (1920), No. 3, pp. 91–146*).—The prices and supplies of agricultural produce in 1920 are reviewed. Tables are given which contain summaries of information as to prices, the imports of the principal foodstuffs, and statistics of important cereals and live stock produced in principal countries for a number of years, continuing information previously noted (E. S. R., 44, p. 389).

Annual agricultural statistics of France, 1919 (*Statis. Agr. Ann. [France], 1919, pp. 452*).—This volume continues agricultural statistics previously noted (E. S. R., 43, p. 795).

Estimates of area and yield of principal crops in India, 1919–20, D. N. GHOSH (*India Dept. Statis., Est. Area and Yield Princ. Crops India, 1919–20, pp. [4]+35, figs. 5*).—Tabulated estimates of area and yields by provinces continue information previously noted (E. S. R., 43, p. 492).

Review of the trade of India in 1919–20, D. N. GHOSH (*India Dept. Statis., Rev. Trade India, 1919–20, pp. [8]+89+VI, pls. 5, figs. 6*).—Statistical tables are given with text and graphic illustrations showing the imports and exports by articles, wholesale prices, and direction of trade.

AGRICULTURAL EDUCATION.

The reorganization of higher agricultural education [in Belgium] (*Rev. Gén. Agron., n. ser., 10 (1920), No. 2, pp. 73–85*).—This is an account of the organization and activities of the Higher Council for the Improvement of Agricultural and Horticultural Education, previously noted (E. S. R., 44, p. 694), including the text of the law of November 15, 1919 (E. S. R., 43, p. 295).

Important changes in the organization of higher agricultural education were promulgated by a royal decree of April 8, 1920, the text of which is given. A license in agricultural sciences is created, to be awarded on the completion of a two-year course, in order to facilitate the access of farmers' sons to the agricultural education institutions. The course for the bachelor's degree, which must be approved by the Ministry of Agriculture, will extend through four years. The first two years will be common to all the students and lead to the degree of candidate for bachelor of agriculture (diplôme de candidat ingénieur agronome). The third and fourth years will be devoted to specialized work and will lead to the bachelor's degrees in agriculture, colonial agriculture, streams and forests, rural engineering, horticulture, agricultural industries or agricultural chemistry (diplômes d'ingénieur agronome, etc.). The subject matter for the first two years and for each of the six sections of the last two years is outlined.

The reform of the higher agricultural instruction institutes and of the agricultural experiment stations in Italy (*Industria, No. 21 (1918), pp. 653–656; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), Nos. 10–12, pp. 1063–1067*).—This is the report of the commission appointed by the scientific and technical committee for the encouragement of Italian industries on the status of higher schools of agriculture and agricultural experiment stations, together with proposals for their reorganization.

It is recommended that the instruction in agriculture be coordinated in the five higher schools of agriculture, three of which are under the control of the Ministry of Agriculture, and the other two under that of the Ministry of Public Instruction. It is deemed advisable that students undergo a suitable practical course before taking up agriculture as a career, and that every school should have a farm of an industrial character, under separate management, and financially self-supporting. The students at the Milan school gain their experience at the peripatetic chairs of agriculture, but this has not been found satisfactory. The organization of the Milan and Portici higher schools of agriculture remains as formerly, the number of professors and assistants being unchanged, while the number of students has doubled and the length of the course has been extended to four years.

The agricultural experiment stations, since their foundation, have been charged with the service of analyzing agricultural materials for public and private institutions, and the enormous increase in the analytical work has led

to the abandonment almost entirely of experimental work. This is considered a step backwards, and it is recommended that the laboratories should be discontinued or restored to real functions of agricultural stations, the analytical work separated from the other departments or turned over to a special institution. Attention is called to the need for five new agricultural experiment institutions, viz, two for southern Italy and one each for Sicily and Sardinia, and one institute of agricultural mechanics; also for increased funds for equipment and maintenance of all agricultural education and research institutions.

Agricultural education in Australia, A. J. PERKINS (*Jour. Dept. Agr. So. Aust., 24 (1921), No. 7, pp. 570, 571, 573–578, 580–585*).—This is a discussion of technical agricultural training in Australia.

A summary is given showing that out of a total of 574 families supplying Roseworthy, Agricultural College with students since its inception in 1883, only 35.2 per cent were engaged in agricultural callings, including 110 farmers. The author contends that while for the bulk of rural workers special technical training, as distinct from home training, is neither necessary, nor indeed possible, from the State viewpoint, the existence of institutions in which this training is imparted is justified so long as they attract a sufficent number of students who by precept and example are able in later life to influence their districts for good. The claim of the city families contributing 65 per cent of the students are considered further justification.

The Australian agricultural colleges have concluded that in the absence of adequate acquaintance with general farming practice, all theoretical instruction must continue more or less futile. Hence every agricultural college (Roseworthy, Dookie, and Hawkesbury) has a large and well-equipped farm on which the manual operations are carried out almost entirely by the students under competent supervision. In the author's opinion, from 60 to 70 students represent perhaps an optimum, 100 a clear maximum, of students who can acquire at any one time a reasonable degree of familiarity and skill on a farm area worked conveniently from a given center. Should this maximum be overstepped, either new colleges must be established, which is deemed neither wise nor desirable at this time, or the existing system of training must receive radical modifications. The maximum number of students could be raised without loss of efficiency in the course of training, if outside farm training were limited to the inexperienced, while the training of farm-bred boys was restricted to theoretical instruction and associated demonstrations. At Roseworthy one-half of the students' time in the 3-year course is now taken up with farm work, so that farm-bred students would thus have much larger opportunities for advanced instruction. If practical training should be eliminated from the college course, it is deemed desirable that the city-bred boy should spend a couple of years on a farm before entering college rather than trust to his acquiring farm practice after the completion of his course. The author emphatically protests, however, against any movement, on the score of economy or any other grounds, that would cause the college farm gradually to disappear, as this would jeopardize not only the ability of the college to impart practical training, but also the efficiency of the technical staff for teaching purposes, for he believes that no agricultural teacher who is not in daily contact with agricultural operations can hope to avoid gradual deterioration.

The author believes that the supply of candidates for the chairs of agriculture that have been established at the universities of Sydney, Melbourne, and Perth, and the one authorized at the University of Adelaide, is bound to be limited by the careers open to those in possession of higher training, which during the present generation at least is not likely to go beyond positions on the technical staff of government departments. The author deems it highly ques-

tionable whether, standing alone, the importance of the work of these technical departments justifies the existence of four separate chairs of agriculture in the Commonwealth. However, competent research work in agriculture would amply justify such chairs.

Farm crops laboratory manual and note book, F. W. LATHROP (*Philadelphia and London: J. B. Lippincott Co., 1920, pp. 118, figs. 44*).—Outlines of 39 suggested laboratory exercises in the study of farm crops are given, together with suggestions for crop growing projects for high school students.

Course in home economics for Idaho schools, G. B. ELWELL (*Idaho Bd. Vocat. Ed. Bul., 3 (1920), No. 1, pp. 89, figs. 4*).—The author outlines the subject matter of a suggested four-year course in home economics for all-day schools in Idaho, and also gives the content of the related courses in science and art which should accompany, and be properly related to, the home economics subjects. The home economics subjects include foods and cookery with a seasonal time schedule (36 weeks); elementary and advanced clothing and textiles (36 and 18 weeks, respectively); elementary dietetics and advanced cookery (18 weeks); household management and housewifery, including the shelter problem (18 weeks); and hygiene, sanitation, and home nursing (18 weeks). A discussion of laboratory arrangement and equipment, a statement of the aims of an 18 weeks' course in economics and sociology as related to home economics, an outline of a short unit home economics course for senior boys only, suggested projects, practical application or demonstrations and class practice, and lists of equipment, texts and references, exhibits, charts, etc., are included. Combining foods and cookery with clothing and textiles in a year's course is deemed highly undesirable, and it is recommended that each of these two branches be taught in a separate full-year course.

MISCELLANEOUS.

The work of the Scottsbluff Reclamation Project Experiment Farm in 1918 and 1919, J. A. HOLDEN (*U. S. Dept. Agr., Dept. Circ. 173 (1921), pp. 36, figs. 2*).—This report includes a summary of meteorological observations from 1911 to 1919, a review of agricultural conditions on the project, and a report of the work on the experimental farm during 1918 and 1919. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Nebraska Station, 1920, E. A. BURNETT (*Nebraska Sta. Rpt. 1920, pp. 54*).—This contains the organization list, a report of the work of the year, a report of the extension service of the college of agriculture, and a financial statement for the fiscal year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Miscellaneous topics (*Porto Rico Dept. Agr. and Labor Sta. Circ. 33 (1920), Spanish ed., pp. 60*).—An account is given of a meeting of producers and sugar makers at Rio Piedras on November 17, 1920, together with the papers presented. One of these, by F. S. Earle, dealt with Varieties of Cane in Porto Rico (pp. 16–19). The remaining papers are abstracted elsewhere in this issue.

New technique for the infiltration and preparation for the microscope of plant and animal tissues, LARBAUD (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 21, pp. 1317–1319*).—By the author's method, the fixed tissue after being passed through the graded series of alcohols in the ordinary way is transferred directly from 95 per cent alcohol to normal butyl alcohol and thence to melted paraffin. Besides shortening the time and saving the expense of absolute alcohol and xylol, it is claimed that the procedure reduces shrinkage of the tissue.

NOTES.

Alabama Canebrake Station.—J. M. Burgess has resigned as director, to accept a commercial position.

Florida University and Station.—The last legislature authorized the establishment of an experiment station in the Everglades on land to be set aside for the purpose by the trustees of the State Internal Improvement Fund. These trustees have designated a tract of 160 acres south of the Hillsborough Canal as the site of the station. An appropriation of $10,000 from funds in the hands of the board of commissioners of the Everglades Drainage District has been made for the maintenance of the station during the biennium ending June 30, 1923, and $5,000 per annum thereafter. These appropriations are also to be duplicated by like amounts from other State funds.

The station is to be under the control of the State Board of Education and Board of Control, which is authorized to cooperate with the Federal Government through the Florida Station. The boards are authorized, with the advice of the trustees of the Internal Improvement Fund, to purchase materials, implements, live stock, and other accessories, and to construct the necessary buildings.

Appointments in the university and station staff, effective October 1, include W. K. Makemson as extension entomologist and plant pathologist and W. E. Stokes as assistant grass and forage crop specialist in the station.

Idaho Station.—J. M. Raeder, instructor in botany and assistant botanist in the Iowa College and Station, has been appointed assistant plant pathologist. His work is expected to include a field study of potato diseases in southern Idaho, and a study of cereal diseases in cooperation with the Office of Cereal Investigations, U. S. Department of Agriculture.

Purdue University and Station.—The new home economics building is under construction. It is to be a two-story building of red brick and terra cotta trimming, with special attention paid to attractiveness of design. The main floor will contain a large corridor suitable for receptions or other small social gatherings, two clothing laboratories, a textile laboratory, three class rooms, two rest rooms, and an auditorium seating 350 people. On the second floor will be two food laboratories, a dietetics laboratory, a room equipped for home nursing, a food chemical laboratory, two class rooms, and offices, together with a small dining room, kitchen, and pantry for practice in meal service. The basement will contain a large cafeteria with accessory equipment, an experimental laboratory, laundry, class rooms, etc.

An allotment for investigation in home economics has been made from the funds of the station.

Miss Inez Richardson and Miss Lelia C. Ogle have resigned as assistants in home economics extension. Recent appointments include Albert A. Hansen, as associate in botany extension, and the following assistants: I. D. Mayer in rural engineering, Miss Ruth Jordan in home economics (for station work), E. C. Young in farm management, and Victor H. Ries in floriculture.

Wyoming University and Station.—Dr. W. C. Boeck has been appointed professor of zoology, and Dr. G. C. Bond assistant professor of veterinary science and assistant bacteriologist. Dr. S. H. Burnett is giving part time to special station problems.

EXPERIMENT STATION RECORD.

VOL. 45. NOVEMBER, 1921. No. 7.

In the death of Dr. Henry Prentiss Armsby, Director of the Pennsylvania Institute of Animal Nutrition, agricultural research in the United States has lost a great leader of thought, its foremost exponent of research in the field of animal nutrition. Active almost to the last, showing little abatement of his customary zeal and with hopes and plans for the future, he was stricken with cerebral hemorrhages in September and died a month later, October 19. His gentle nature, his broad sympathies and interests, his generosity in giving his time to others, his tolerance, and his patience in the pursuit of his ideals made him one of the noblest of men.

For more than forty years Dr. Armsby had been closely identified with the work of our agricultural institutions. While length of service alone does not measure the value of a life or the contribution it represents to human welfare, in his case the product of his years was more than commensurate with the time covered. To an unusual extent it was out upon the frontier of human knowledge, pointing the way and leading in the prosecution of original inquiry. His scholarly interpretation of the purpose and the method of agricultural research and his influence in the development of it in the American experiment stations were felt in every State, and were in no sense a minor feature of his useful career.

Dr. Armsby was born in Northbridge, Mass., September 21, 1853. His boyhood was spent in town, and he graduated from Worcester Polytechnic Institute, in 1871. He was interested in chemistry, especially the analytical branch, studied at Sheffield Scientific School at two periods, and received his doctorate there in 1879. In 1875 he went to Leipsic for study, coming in contact with several of the leading agricultural experts in the university, and with Gustav Kühn and his contemporaries at the Möckern Experiment Station nearby.

Dr. Armsby's connection with agricultural investigation dates back almost to the beginning of the stations in this country. He entered the service of the Connecticut State Station in 1877, two years after its establishment; and with the exception of an interval of two years in which he was vice-president of the Storrs Agricultural School (now the Connecticut Agricultural College), he was continuously in the service of the experiment stations from that time until his death.

With the organization of the experiment station in Wisconsin in 1883 he became chemist, retaining that position until 1887, when with the passage of the Hatch Act he was called to Pennsylvania State College to organize the experiment station in that State. He remained director of the station until 1907, being for part of the time dean of the school of agriculture. In that year he was relieved of the larger administrative duties of the station, and through the establishment of the Institute of Animal Nutrition was enabled to concentrate his attention on his special line of inquiry.

The honors which came to him reflected the international esteem in which his work was held. The University of Wisconsin conferred its Doctor of Laws upon him in 1904, and Yale University and his Alma Mater, Worcester Polytechnic Institute, the honorary degree of Doctor of Science in 1920 and 1921, respectively. He was elected a member of the Royal Society of Arts of Great Britain in 1911, and a foreign member of the Royal Academy of Agriculture of Sweden in 1912. He was made a member of the National Academy of Science in 1920. He held office in the prominent organizations for agricultural science in this country, and served in many important public positions. With the formation of the National Research Council, he became a member of the Committee on Food and Nutrition, and in the fall of 1918 he was sent to Europe by the United States Government as a member of the Interallied Scientific Food Commission.

Dr. Armsby was in no sense a cloistered scientist. Although devoted to his research, he maintained a keen interest in all that applied to the progress of agricultural education and inquiry, and the utilization of the latter for the public good. To these ends he gave generously of his time and his best thought, and for over forty years he was a wise and inspiring leader in the councils of our agricultural institutions. He never shirked an opportunity for service or a chance to stimulate interest in research and education.

The Association of American Agricultural Colleges and Experiment Stations was one of the prominent agencies through which his service and influence were exerted. His connection with that association dated from its very inception. He was one of those called to Washington by the Commissioner of Agriculture in July, 1885, to a convention of delegates from the agricultural institutions, out of which the Association developed two years later. He held all the important positions in that Association, being secretary in 1890, president in 1899, a member of its executive committee, and on various other committees of importance. For example, he headed the Association's committee on the experiment station exhibit at the World's Columbian Exposition at Chicago in 1903, and the Paris

Exposition in 1900. In 1906 he proposed the appointment by the Association of a Commission on Agricultural Research, being one of the Association's members on that Commission, which reported in 1908.

He was a member of the Committee on Graduate Study from 1906 and chairman from 1909 until it was discharged in 1920. When in 1914 the newly established *Journal of Agricultural Research* of this Department was thrown open to contributions from the agricultural colleges and experiment stations, he was appointed on its editorial committee, serving until 1919, part of the time as chairman of the college branch of the committee.

All of these duties he discharged in a conscientious manner which gave a high value to his service. In addition, he contributed an unusually large number of papers and discussions which represented the product of a mature, deliberate mind.

Almost from the first he was a prominent exponent of the idea that the advancement of agricultural practice on a sure basis must be sought through the channels of research. He did not lose sight of the practical applications of research or the temporary value of many of the experiments of a less intensive character, but he was sufficiently farseeing and clear-sighted to stress the importance of thoroughgoing inquiry which should not be wholly content with observed facts, but seek reasons.

His attitude of thoroughness is shown in the first bulletin issued by him from the newly organized experiment station in Pennsylvania. In this he said, after pointing out the purpose of the station to select for study problems which appeared to be of most immediate practical importance: "It will seek to do thorough, conscientious work; to do a few things well, rather than many superficially." This was thoroughly typical of him at a time when men had not begun to see so clearly.

Again, in a discussion of the question of abstract research *v.* practical experiments, he declared that each had its place in the work of the experiment stations, that there was no innate antagonism between them, and that "no high ideal worthily followed ever interfered with faithfulness to the humblest duties." He added his belief that "the station with the highest ideal of its functions will be the most efficient in the simpler and more prosaic duties which are a legitimate and proper and important part of its work."

Nowhere perhaps were his views regarding the motive and the method of the experiment station more clearly developed than in his address as president of the Association of Agricultural Colleges and Experiment Stations in 1899. At least it is typical of the man and what he stood for, and it was so clear cut and logical that it still

carries a lesson for to-day. Experience and what has been said since that time have merely confirmed and added emphasis to his words.

At that time the American station system was only twelve years old, and it was largely thought of as being quite distinct from the functions of the college and devoted primarily to the assistance of the farmers. Dr. Armsby's conception, therefore, of the stations as essentially educational, like the colleges to which they had been attached, was a somewhat novel one, and he impressed it as important in giving tone and direction to thinking at that time. He maintained that the function of the station is not the impossible task of giving the farmer recipes suited to every conceivable agency—it is not a device to save the farmer the trouble of thinking; it is its business to enlarge his knowledge, to make him think more, and only to the extent to which he can by such thinking digest and assimilate the station's help can the latter expect to assist him permanently and effectively. "The true field of the experiment station is the farmer's mind, not his acres," he said.

He viewed the experiment station, therefore, as "our agricultural university, devoted to the advancement of learning, the promoter of investigation, the source not merely of knowledge but of inspiration for the whole organism." In assigning it to its true place in the system, he insisted on the recognition of its work as that of higher education, and that it was unwise from an educational standpoint to hamper and dwarf it by requiring work of a lower grade. "In my judgment," he declared, "the ideal experiment station should be as fully separated as possible from the details—the daily grind—of under-graduate instruction, while retaining its general supervision and inspiration," which led him to caution against burdening it with farmers' institute, nature study, and extension activities then beginning, and to plead that confusion should not be added by including these in the field of the station, important as they were. Because the need for direct assistance was so real and the argument so plausible, he called for the protection of the station in its work of investigation, not alone on account of the direct usefulness of the results to the farmer, but because the station work "is an integral part of our system of agricultural education, and if we destroy it we emasculate the whole system."

The logic of this is so evident to-day that it is still a basis of contention for larger maintenance funds, in order that the objects of the agricultural colleges in teaching and extension may be accomplished and the real democracy of these institutions be attained.

As to the requirements for station investigation, Dr. Armsby pointed out that the successful station man needs to be a scholar as well as a worker, and this led him to emphasize the indispensableness of training, the fact that no zeal nor facility nor practical experience can take the place of it. "No matter what else he has," he

said, "the station worker must have a thorough scientific training, not for the sake of the knowledge which is acquired by that means, but for the sake of the power which it imparts." These are matters which more than twenty years have not relieved the necessity of expounding and emphasizing, as is shown by the continued appointment or assignment of men to the station work whose degrees bear scant evidence of advanced study.

And as to the station director, the man upon whom rests the guidance and to large extent the degree to which the station measures up to its mission, he took the courageous stand—courageous because practice and precedent were quite largely against him at that time—that "if the real essential function of the station in this [educational] system is the promotion of original investigation, and if the prime qualification of the station worker is that bent of mind and that scientific training which qualify him to investigate, should not the head of the station have some personal knowledge through experience of what constitutes real investigation? . . . In the combined attack on the domain of ignorance by the army of station workers should he not say 'come' rather than 'go'? May it not be well to set before ourselves more distinctly as an ideal the 'director who inspires'"?

Dr. Armsby's prominence in connection with the subject of animal feeding and nutrition dated from the publication of his Manual of Cattle Feeding in 1880. This was while he was at the Connecticut Experiment Station, and as his preface tells us, was originally begun as a translation of Wolff's book which was the current manual on feeding at that time. In the course of its preparation, however, he found it desirable to adapt it to suit the needs of American readers, and to enlarge it by the inclusion of considerable additional material.

The book brought together for the first time not only the results of investigation to date on the subject of feeding, but also the processes by which the results had been reached. It gave, therefore, a larger insight into the methods of investigation in that subject, and supplied a stimulus to interest in it. Up to that time the experimental work of the stations had been largely concerned with soils, fertilizers, and the growth of plants, but the publication of this manual was followed by increased attention to experiments in the feeding of live stock and the utilization of farm products in that way. It was long standard as a textbook and passed through several editions.

The beginning made with this book foreshadowed his career. To increasing extent he gave his chief attention to feeding problems, and soon became recognized as one of the leading experts in animal nutrition. This led to the proposal of the Federal Department of

Agriculture in 1898 that the Pennsylvania Station undertake in cooperation with the Bureau of Animal Industry a series of investigations into the fundamental principles of nutrition, the work to be in his charge. The proposal was accepted and the cooperation marked the beginning of more intensive study in that field. This cooperative arrangement continued for more than twenty years.

The Atwater-Rosa respiration calorimeter had been successfully developed for experiments with man, and it was decided to construct a similar apparatus for experiments on cattle. This was begun in 1898, the Department providing financial assistance in procuring the necessary special apparatus and installing it. The construction of this respiration calorimeter involved several difficulties not encountered in the apparatus in which man was used as the subject.

It was necessary not only to increase the size of the respiration chamber but to introduce various special features so that the operation of feeding, weighing, collecting the excreta, etc., could be performed from without, since the cooperation of the subject could not be counted on. Among the most interesting of these features were the devices for weighing the heat absorbers from the outside, the air-lock for introducing feed and water, and arrangements for the collection of the liquid and solid excretory products. The apparatus made possible for the first time the determination of the total income and outgo of both matter and energy with animals. It marked, therefore, a new era in research in that field.

The first experiments with the apparatus were made in the winter of 1901–2. These fortunately gave results of much interest, both from a practical and a scientific standpoint. The conclusions reached with reference to the maintenance ration and the replacing value of nutrients were at once seen to mark important advance, and the possibilities which the apparatus opened up for studies of a great variety of physiological questions, the energy required to digest and assimilate different classes of feeding stuffs, and the checking of results secured by the more practical methods of feeding experiments, became apparent.

As the work progressed, it was evident that its effective prosecution required a larger amount of Dr. Armsby's personal attention, and at his request he was relieved of the duties of dean of the school of agriculture. A further measure of relief was decided upon a few years later in the separation of these investigations from the remaining work of the station and the establishment of an Institute of Animal Nutrition. This was to be affiliated with the experiment station and receive a part of its support from that source. It was not until 1907, however, that this plan could be finally carried into effect.

Despite the advanced step taken by the trustees of the college in promoting this specialized line of inquiry no specific appropriations were ever secured for the maintenance of the Institute, and it is a

matter of regret that at no period in the fourteen years from its establishment was it assured a permanent, definite means of support. It was assigned such funds as could be spared from the general allotments for agricultural work, and these, together with the contributions from the Department of Agriculture and the Adams fund, sufficed to provide for the necessary salaries and urgently necessary supplies. Contributions from outside sources were received from time to time, but the uncertainty and the limited character of the support, aside from being a source of anxiety, doubtless prevented the greatest measure of usefulness. With a patience and a courage which were undaunted, Dr. Armsby carried his work forward from year to year, confident that a way would ultimately be found for its development. When support from this Department was discontinued in the summer of 1920, owing to reduction in appropriations, the assistance of the Rockefeller Institute for Medical Research was secured for a time, and the attempt was made to enlist interest in other quarters.

In recent years, Dr. Armsby dreamed of a national institute of nutrition, and he outlined a plan for such an institute, designed to be distinctly national in character—a means of integrating and coordinating the activities of the various agencies of investigation, free from executive duties, under the control of scientific men, and embracing the statistical, physiological, and agricultural aspects of the broad subject. He had given considerable attention to this enterprise of late, and at the time of his death it was under consideration by the Committee on Food and Nutrition of the National Research Council, of which he was a member.

Who shall estimate the value of his work and his influence—its meaning to American agriculture, to the American experiment station system, and to the science of nutrition? Certainly only one who sees it in all its bearings and in its potential applications to the theory and practice of animal feeding. Some measure of its significance, however, is apparent to the nonexpert observer.

Dr. Armsby did more than perfect a mere machine, adapt an instrument of precision to measure the economy of the animal mechanism through study of the balance of nutrients and energy as a matter of theoretical interest. He developed a method and an instrument of investigation, and he employed it in working out some of the most fundamental of the laws which govern the requirements and the use of food by animals. He not only gave us a broader and more substantial basis for intelligent feeding practice, but supplied the foundation on which to base a sound agricultural policy, should necessity require.

He gave us a new means of measuring animal feed on the basis of its energy supply, its ability to provide for immediate use or in

stored up form the materials from which heat and energy are developed. He studied the economy of matter and energy in the animal under different conditions of feeding as to amount, kind and nature of the food material, the age and type of the animal, environmental factors, etc. He taught that "quantitatively the principal function of food is to supply energy", and hence that "a knowledge of the relative amounts of energy which can be recovered in various methods of utilization is a factor of prime importance in food conservation."

Having simplified the feeding standards to the two factors of protein and therms, he worked out the net energy value of the principal American feeding stuffs and the methods of using them in computing rations for different conditions and purposes. His earlier work was done with steers, but later he took up the study of the metabolism of the dairy cow, paying special attention to the basal katabolism or breaking down of materials.

For a series of years he studied the basic principles which underlie and condition the successful economic transformation by the animal of products unavailable to man into human food. In that connection he dealt with the energy content of different feeding stuffs, the proportion transformed to man's use, the relative efficiency of different types and ages of animals as such convertors of "waste" energy, and the effect of the various conditions under which animals are kept upon their efficiency as producers of human food.

Since food is produced primarily from the constituents of the soil and the air through the agency of the higher plants, the motive power being the sun's rays, and since these plant products supply the stored up matter and energy upon which man and animals depend, he argued that the adjustment of the human and animal food supplies furnishes a basis for the conservation of food and a national policy. He disclosed in a very striking way the great losses of energy which may be involved in the conversion of vegetable materials into animal products in feeding live stock. For example, assuming that the proper amount of coarse fodder is supplied to the animal, he calculated that from 39 to 86 per cent of the energy of grains consumed by animals is lost in one way or another, leaving only 14 to 61 per cent to be recovered for man's use. Such a diversion to stock feeding of any material suitable for direct human consumption, he considered from this standpoint a wasteful procedure.

He showed, furthermore, the larger economy of food materials in the production of pork and milk as compared with that of beef and mutton, owing to the extensive fermentation occurring in the stomach of cattle and sheep, and the relatively large proportion of inedible material in the carcass. He called attention to the highly important function animals perform in the economy of nature in utilizing prod-

ucts unsuitable to man or inedible by him. Thus, the great number of pasturage and forage crops and the inedible products of milling and manufacturing are conserved by animals and become through that medium a means for man's support.

Dr. Armsby published two books which were made possible by his studies and his advanced knowledge of the subject. His Principles of Animal Nutrition appeared in 1903, a systematic summary of principles adduced by research, considered particularly from the standpoint of energy relations. The volume was based on a series of lectures he gave at the first session of the graduate school of agriculture, held at Ohio State University in 1902. In 1917 he issued his volume on The Nutrition of Farm Animals, a very comprehensive survey and digest of nearly 750 pages, dealing primarily with the fundamental principles upon which successful stock feeding rests, and designed for the student rather than directly for the general feeder. These volumes are monuments to his patience and skill as a compiler and to his critical ability in digesting and presenting in their true perspective the products of research in that field. A small volume on The Conservation of Food Energy, issued in 1918, presented in condensed form the salient results and principles regarded as applicable to the then existing food situation.

Fundamental as Dr. Armsby's work was, and important as are its applications in relation to feeding and the large questions of food supply, it was only in part understood. In its broader and more essential reaches it had not within itself the elements of popularity. It was quite highly technical, and for the time being much of it related to basic principles rather than immediate applications in practice. He was too busily occupied and too cautious to attempt the broad generalizations which some might have made to emphasize its popular importance. His quiet modesty was doubtless another factor in the situation. But it commanded universal respect, and was accepted as being right in character, filling an important need, and deserving of liberal support. His passing brings a realization of the misfortune of delay.

Dr. Armsby won high honors, for himself not only, but for his institution and for the system with which he was so long connected. He was a proud possession. The lines of research in which he was a national leader were not completed—they were only well under way. They opened up well-nigh unlimited possibilities for extending the boundaries of exact knowledge in relation to a subject of vast importance. What he did has prepared for larger accomplishment, which with each step will bring more directly home the significance of such inquiry to both theory and practice.

He has left a monument such as few men can boast, and his work will live on and continue to fruit in the lives of those who succeed him.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Colloid chemistry, R. ZSIGMONDY (*Kolloidchemie. Leipzig: Otto Spamer, 1920, 3. ed., rev. and enl., pp. XVI+429, pls. 7, figs. 63*).—This third revision of the textbook previously noted (E. S. R., 28, p. 407) contains an additional section by P. Scherrer on the determination of the inner structure and size of colloid particles by means of Roentgen rays.

Annual reports on the progress of chemistry for 1920, edited by J. C. CAIN (*Ann. Rpts. Prog. Chem. [London], 17 (1920), pp. X+264, figs. 7*).—This is the usual annual report (E. S. R., 43, p. 409).

Solid culture media with a wide range of hydrogen or hydroxyl ion concentration, F. A. WOLF and I. V. SHUNK (*Jour. Bact., 6 (1921), No. 3, pp. 325–330*).—In this contribution from the North Carolina Experiment Station the authors present evidence that it is possible to prepare solid gelatin or agar media within and even beyond the ordinary limits of tolerance of microorganisms. The media were prepared by adding either 1 or 2 per cent commercial agar or 10 or 15 per cent bacto-gelatin to a bouillon consisting of 0.3 per cent Liebig's beef extract, 1 per cent Armour's peptone, and 0.5 per cent sodium chlorid. This was then heated in an autoclave, flasked, and sterilized for 15 minutes at 15 lbs. pressure in the case of agar and 5 lbs. pressure in the case of gelatin. On removal from the autoclave the agar was cooled to about 50° C. and the gelatin to about 40° before the addition of the acid or alkali. Ten cc. portions were measured from a pipette into test tubes and varying amounts of acid or alkali were added with a 1 cc. pipette graduated in tenths, the tubes being then shaken and cooled. The acid used was hydrochloric with a specific gravity of 1.2 and the base sodium hydroxid, specific gravity 1.226.

The limits of solidification of 1 per cent agar were approximately 5.11 per cent acid and 0.39 per cent alkali and of 2 per cent agar 6.51 per cent acid and 0.58 per cent alkali. In the case of 10 per cent gelatin the limits were about 9.02 per cent HCl and from 3,33 to 4 per cent NaOH, and of 15 per cent gelatin from 9.02 to 10.15 per cent HCl and about 4 per cent NaOH. All of the agar media between the limits mentioned remained solid for an indefinite period when maintained at room temperature, but if autoclaved and again cooled all of the acid media and some of the alkali media remained liquid. With the gelatin media, after storage in the ice box at about 10° for 12 hours, all of the tubes which had more than 1 cc. of NaOH had become liquid, while the others were still solid. On placing the tubes which had remained solid in boiling water until the media had liquefied and cooling again to 7.5°, the alkaline gelatin again solidified, while the limit of the jellifying power of the acid media was somewhat reduced.

The reciprocal transformations of creatin and creatinin, A. HAHN and G. BARKAN (*Ztschr. Biol., 72 (1920), Nos. 1–2, pp. 25–36, figs. 1; 9–12, pp. 305–313*).—A study is reported of the changes of creatin and creatinin in acid and alkaline solutions as shown by colorimetric determinations of the resulting products.

The reaction of the change from creatin to creatinin and vice versa in alkaline solution was found to be an incomplete reaction of the first order, with a well-defined point of equilibrium. In acid solution creatin was transformed completely into creatinin, with the formation of soluble creatinin cations. This reaction has been made the basis of a method of determining creatin and creatinin in urine essentially as follows:

A portion of the urine to be tested is diluted with an equal amount of water and the preformed creatinin determined colorimetrically with the picric acid-sodium hydroxid reagent. Another portion is diluted with an equal volume of 2N HCl, heated in a thermostat for 24 hours at 60° C., neutralized with N KOH, and the creatinin content determined as above.

A simple method for the preparation of creatin from meat extract, H. STEUDEL (*Hoppe-Seyler's Ztschr. Physiol. Chem., 112 (1921), No. 2–4, pp. 53, 54*).—The technique of the method is as follows:

One kg. of Liebig's meat extract is extracted with 2 liters of absolute alcohol in a round-bottom flask in a water bath under a reflux condenser until the alcohol acquires a reddish-brown color and a sirupy mass settles to the bottom of the flask. The extraction is repeated twice, the insoluble portion becoming hard and gritty and the alcohol no longer turning yellow. The alcohol is distilled from the combined extracts, and after standing for several hours the creatin crystallizes out. From one recrystallization white glancing crystals are obtained of pure creatin. The yield is said to be about 25 to 30 gm. of air-dried creatin from 1 kg. of the extract.

The presence in the urine of a nitrogenous residue which can not be determined by the Kjeldahl method, W. MESTREZAT and M. P. JANET (*Bul. Soc. Chim. Biol., 3 (1921), No. 3, pp. 88–94*).—Essentially noted from another source (E. S. R., 44, p. 804).

The synthesis of inosite-hexaphosphoric acid, S. POSTERNAK (*Helvetica Chim. Acta, 4 (1921), No. 1, pp. 150–165, figs. 2*).—In reply to the paper of Anderson (E. S. R., 44, p. 410) in which he reported inability to confirm the author's results in the synthesis of inosite-hexaphosphoric acid, the experimental work and analytical data which were not reported in the earlier paper are given in detail and discussed in reference to Anderson's method and findings. The author concludes that the use of phosphoric anhydrid at 120° C. as the dehydrating agent in the esterification of phosphoric acids by inosit results unquestionably in the formation of inosite-hexaphosphoric acid with a minimum yield of 8 per cent. The separation of the acid takes place readily after heating the product of reaction with an excess of sodium hydroxid, a double salt of calcium and sodium being formed. The negative results obtained by Anderson are thought to be due to faulty methods selected for treating the reaction product. The earlier statement is reiterated that the synthetic inosite-hexaphosphoric acid is identical in chemical and crystallographic properties of its salts with the principal phospho-organic material of green plants.

Fat associated with starch, T. C. TAYLOR (*Diss., Columbia Univ., New York, 1920, pp. 19*).—This dissertation reports in full the experimental data from which were drawn the conclusions in the previously noted paper by Taylor and Nelson (E. S. R., 44. p. 111).

The formation of acetaldehyde in the decomposition of sugars by fungi, C. COHEN (*Biochem. Ztschr., 112 (1920), No. 1–3, pp. 139–143*).—Acetaldehyde was identified in the fermentation products of the action on dextrose of the fungi *Aspergillus cellulosae, Monilia candida, Mucor racemosus, M. rouxii,* and *Oïdium lactis.*

Acetaldehyde as an intermediary product in the fermentation of sugar by Bacillus lactis aerogenes, C. NEUBERG, F. F. NORD, and E. WOLFF (*Biochem.*

Ztschr., 112 (1920), No. 1–3, pp. 144–150).—The identification of acetaldehyde as an intermediary product of the action of *B. lactis aerogenes* on glucose, together with the findings reported in the above paper, is thought to demonstrate that in many types of sugar fermentation acetaldehyde plays an important rôle.

Preliminary note on a stable silver vitamin compound obtained from brewer's yeast, A. SEIDEL (*Pub. Health Rpts. [U. S.], 36 (1921), No. 13, pp. 665–670, figs. 2*).—The method of obtaining the stable silver vitamin compound described is essentially as follows:

Activated fuller's earth, prepared by adsorption of autolyzed brewer's yeast on fuller's earth (E. S. R., 35, p. 472), is shaken vigorously with saturated aqueous $Ba(OH)_2$ solution in the proportion of 1 liter of the latter to 100 gm. of the former, and the solid portion removed as quickly as possible. The liquid is immediately acidified with a slight excess of concentrated H_2SO_4, a moderate excess of powdered $BaCO_3$ added to remove the acid, and the mixture filtered after 30 minutes. Nearly saturated lead acetate solution is then added to complete precipitation, the precipitate removed, the excess lead precipitated with H_2S, and the filtrate from this precipitation evaporated rapidly under reduced pressure to about one-tenth or one-twentieth its original volume. A white amorphous precipitate which separates as the volume becomes small is from time to time removed, and the evaporation is continued in a vacuum desiccator until no further precipitate is formed. The extract on evaporation to complete dryness has been found to retain its antineuritic properties indefinitely.

On diluting to a volume of 25 cc. the extract prepared as above from 300 gm. of activated fuller's earth, and gradually adding an almost saturated aqueous $AgNO_3$ solution, a voluminous silver precipitate is obtained. After removing this by centrifugation and treating the filtrate and wash water with an excess of fairly concentrated aqueous ammoniacal $AgNO_3$ another voluminous silver precipitate is formed. On testing the two precipitates and final filtrate on pigeons, the second precipitate was found to be highly antineuritic. This precipitate can be further separated into a nonactive crystalline portion and an active amorphous substance by treating with excess HCl, removing the precipitated silver chlorid, evaporating the clear liquid, and precipitating with ammoniacal $AgNO_3$. The yield of dried material from 300 gm. of activated fuller's earth was 0.7 gm. The substance is only slightly soluble in water and contains 54.8 per cent of silver. The protective dose for pigeons is 0.002 gm. per day, which is equivalent to slightly less than 0.001 gm. of the antineuritic portion of the material.

The activity of phytase as determined by the specific conductivity of phytin-phytase solutions, F. A. COLLATZ and C. H. BAILEY (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 317, 318, figs. 2*).—In this contribution from the Minnesota Experiment Station the results are reported of the study of the influence of temperature upon the activity of phytase as determined by the electrical conductivity of solutions of phytin treated for varying periods of time at different temperatures with active phytase from wheat bran. The results obtained show that changes in the specific conductivity of a water solution of phytin and phytase afford a convenient measure of the progress of the hydrolysis. A temperature of about 55° C. was found to be optimum for the hydrolysis of the phytin, although it proceeded more rapidly during the first 15 minutes at 60°.

Researches on Sardinian Opuntia (prickly pear), E. PUXEDDU and A. MARINI (*Gior. Chim. Indus. ed Appl., 3 (1921), No. 3, pp. 95–97*).—The experimental work reported consisted of determinations of the sugar content of the

juice and rind of the fruit of the prickly pear and of the physical and chemical constants of the oil from the seeds.

The sugar content of the juice varied from 12 to 13 per cent, while the average amount in the rind, which comprises 45.2 per cent of the fruit, was 1.49 per cent. Extraction of the ground seeds with carbon tetrachlorid yielded 7.98 per cent and with petroleum ether 6.58 per cent of an oil of a reddish yellow color which gave the following constants: Index of refraction 1.476 to 1.475, specific gravity 0.9179 at 25° C., acid number 4.985, saponification number 160.5, iodin number (Hübl) 103.06, acetyl number 174.1, and Hehner number 95 to 96.5.

Chia seed oil (*Bol. Agr. Indus. y Com. Guatemala, 1 (1921), No. 1, pp. 21, 22*).—Determinations of moisture, oil extracted with petroleum ether, and the fatty acids liberated from the oil of six samples of chia seed (*Salvia hispanica*) are reported.

The oil, the yield of which varied from 23.19 to 39.87 per cent, was of a clear greenish color bleaching on exposure to light. Its odor was similar to linseed oil and in general this resemblance extended to other properties. It is thought that the oil might be preferable to linseed oil for paint on account of its remarkable limpidity and transparency.

[Eucalyptus oils], R. T. Baker and H. G. Smith (In *A Research on the Eucalypts, Especially in Regard to Their Essential Oils. N. S. Wales, Technol. Mus., Tech. Ed. Ser., No. 24 (1920), pp. 335–471, figs. 38*).—The third part of this volume, which has been noted in full (E. S. R., 45, p. 350), consists chiefly of tables of physical and chemical constants of eucalyptus oils, with a description of analytical methods employed in the examination of the oils.

The production of artificially dense charcoal, L. F. Hawley (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 301, 302, fig. 1*).—Attempts at the U. S. Forest Products Laboratory, Madison, Wis., to produce an artificially dense charcoal suitable for use in gas masks in place of coconut-shell carbon led to the discovery that a satisfactory product could be obtained by distilling under pressure briquets made from the material obtained by hydrolyzing sawdust with dilute acid and leaching out the sugar. Briquets 2 in. in diameter and 6 in. deep, when distilled under a pressure of 300 lbs. per square inch at a final maximum temperature of 450° C., gave a 40 per cent yield of charcoal with an apparent density of 0.62 and an absorption value for chloropicrin of 700 minutes as compared with the standard coconut-shell charcoal value of 0.63 and 900, respectively.

Nitrogen titratable by the Kjeldahl method, W. Mestrezat and M. P. Janet (*Bul. Soc. Chim. Biol., 3 (1921), No. 3, pp. 105–130*).—This is a critical review of the literature on the Kjeldahl determination for nitrogen with its many modifications. In conclusion the authors classify nitrogenous compounds from the point of view of the possibility of their determination by the Kjeldahl method as follows:

(1) Compounds the nitrogen of which is easily determined by the Kjeldahl method, including aliphatic amins, some aromatic amins, imins, amids, ureids, the pyrrol nucleus, the pyrimidin nucleus, and purin and its derivatives; (2) compounds in which the nitrogen determination is possible but difficult, including guanidin derivatives, indol and skatol, the quinolin nucleus, acridin, piperazin, morphin, brucin, etc.; (3) compounds in which the determination is difficult and furnishes only doubtful results, including some aromatic amins, quaternary ammonium compounds, the tropic nucleus, and tyrosin; (4) compounds in which the direct determination of nitrogen is impossible, but possible after reduction, including nitrates, nitrites, nitroso derivatives, nitriles, derivatives of cyanogen, hydrazins, hydrazones, and osazones, and azo- azoxy- and diazo derivatives; and (5) compounds in which the nitrogen can not be

determined in the wet way, including pyridin and pyrazol and their derivatives. An extensive list of literature references is appended.

Volumetric determination of sulphuric acid, C. PEZZI (*Gior. Chim. Indus. ed Appl., 3 (1921), No. 1, pp. 10, 11*).—A modification of the method of determining H_2SO_4 as benzidin sulphate, as originally proposed by Müller (E. S. R., 15, p. 121), is described in which the titration of the benzidin sulphate is conducted with N/20 $NaNO_2$. The method has the advantage of being applicable even in the presence of ferric salts and is said to have an approximation of about 0.2 per cent.

Rapid dry combustion method for the simultaneous determination of soil organic matter and organic carbon, J. W. READ (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 305–307, figs. 3*).—A method which is said to make possible simultaneous determinations of soil organic matter and organic carbon with rapidity and accuracy is described. The rapid organic combustion method as modified by Levene and Bieber[1] forms the basis of the scheme adopted, while the success of determining on the same sample of soil both the organic matter and the organic carbon is attributed chiefly to the use of a special perforated-bottom combustion boat and a specially constructed filter funnel, making it possible to filter by suction in the same manner as with the ordinary Gooch crucible. The method is described in detail with diagrams of the entire apparatus, including the purifying and absorbing bulbs. Data are included on the analysis of 14 soils by the method described.

A note on the modification of the Van Slyke method of protein analysis, P. MENAUL (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 351, 352*).—A modification of the Van Slyke method of protein analysis devised for the analysis of the proteins of the pecan at the Oklahoma Experiment Station "consists in precipitating the humin and ammonia from the protein hydrolysate by phosphotungstic acid (15 gm. for 3 gm. of protein), in 150 cc. of boiling solution containing about 10 per cent H_2SO_4 or HCl, and allowing to stand for several hours, until cold. The phosphotungstates of the basic amino acids are brought unto solution by again heating to boiling for a few minutes on a sand bath and the insoluble phosphotungstates of ammonia and humin filtered off and washed with 50 cc. of boiling 10 per cent acid. Enough phosphotungstic acid, 5 to 10 gm., is now added to the filtrate to precipitate completely the hexone bases, and the solution is set aside for these to precipitate. The usual procedure for the determination of the hexone bases is followed from here on."

The ammonia is determined by making the residue alkaline and distilling. The humin is determined in an aliquot of the original hydrolysate by adding slowly, with constant stirring, a 10 per cent solution of sodium tungstate to the hot 10 per cent acid solution until the humin is precipitated as a black curdy mass and the supernatant liquid is clear. The humin is then filtered off, washed with 10 per cent acid and the nitrogen determined by the Kjeldahl method.

Duplicate analyses of gliadin by this procedure are reported.

The analysis of partially hydrolyzed fats, W. FAHRION (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze, 28 (1921), No. 6, pp. 68, 69*).—For determining the amounts of neutral fats in partially hydrolyzed fats the following method is suggested:

A weighed amount of the fat is heated with alcohol and the acid number determined. A given amount of alcoholic base is then added and the saponification number determined with the help of a blank test. The resulting neutral soap solution is made alkaline, diluted with 50 or 20 per cent alcohol, and the unsaponifiable fraction shaken out with ether or petroleum ether. The neutral

[1] Jour. Amer. Chem. Soc., 40 (1918), No. 2, pp. 460–462.

fat is then calculated from the formula $X=\frac{(100-Y)\times \text{acid number}}{\text{saponification number}}$, where Y=the determined percentage of unsaponifiable matter and 100—(X+Y)=the neutral fat.

Studies on the determination of crude fiber, O. Nolte (*Landw. Vers. Sta., 96 (1920), No. 5–6, pp. 325–337; abs. in Jour. Soc. Chem. Indus., 40 (1921), No. 2, p. 57 A*).—The author reviews the details of the original method of Henneberg for the determination of crude fiber, and the various modifications which have been introduced from time to time in the technique. Experimental data on the influence of various factors are also reported. The views of Henneberg were confirmed that preliminary removal of the fat makes little difference in the resulting determination. The fineness of grinding was found to have little effect on substances with a soft structure, but with hard substances the amount of crude fiber tended to decrease with fine grinding. Other factors tending to influence the results were the size of the evaporating dish, rapidity of boiling, and strength of acid and alkali.

Contribution to the selection of a simple and reliable method for determining the degree of hydrolysis of crude fiber, Von Wissell (*Landw. Vers. Sta., 96 (1920), No. 5–6, pp. 263–275*).—The author discusses various methods for determining the degree of hydrolysis and consequent digestibility of feeding stuffs prepared by digesting the straw of cereals and other materials rich in cellulose with dilute alkali. The procedure recommended is the determination of the loss in weight on hydrolysis with 1 per cent NaOH, the application of the phloroglucinol test for lignin, and the determination of the chlorin absorbed from bleaching powder. A table is given of the results of such an analysis with a number of feeding stuffs thus prepared.

A volumetric method for the determination of lactose by alkaline potassium permanganate, F. T. Adriano (*Chem. News, 122 (1921), No. 3182, pp. 157–159*).—Previously noted from another source (E. S. R., 45, p. 12).

The valuation of marmalades, particularly the determination of sugar content, H. Serger-Braunschweig (*Ztschr. Öffentl. Chem., 26 (1920), Nos. 16, pp. 186–188; 17, pp. 194–199*).—Methods for the analysis of commercial marmalades for the detection of adulteration and misbranding are discussed, with experimental data.

Studies of wheat flour grades.—I, Electrical conductivity of water extracts, C. H. Bailey and F. A. Collatz (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 319–321, figs. 2*).—This paper reports a comprehensive study of the factors governing the conductivity of water extracts of wheat flour with a view to determining the relation existing between the electrical conductivity and ash content of flour of different grades. The preliminary procedure consisted in suspending 10 gm. of the flour in 100 cc. of carefully prepared conductivity water, and allowing the flask containing the mixture to remain for varying lengths of time in a water thermostat. The clear liquid obtained by centifuging, decanting, and finally filtering was then used for conductivity measurements.

The specific conductivity obtained was found to vary with the time and temperature of extraction, a temperature of 60° C. or somewhat less giving the highest figures. The similarity in response to temperature changes of the water extracts of flours and of phytin-phytase preparations, as noted above, is thought to indicate that the conductivity of water extracts of wheat flour is due chiefly to inorganic salts of phosphoric acid resulting from the hydrolysis of phytin by the enzym phytase. In comparing several flours by the conductivity method the necessity is emphasized of maintaining uniform conditions with respect to time, temperature, and ratio of flour to water. The conditions arbi-

trarily selected in the present study consisted in the extraction of 1 part of flour with 10 parts of water at 25° for exactly 30 minutes, after which the conductivity of the clear extract was measured at 30° with a dip electrode.

Determinations by this method of the electrical conductivity of flour streams are reported and compared with the ash content of the same flours. The ratio of conductivity to ash content thus obtained was found to be sufficiently exact to permit the employment of the specific conductivity method as an index of flour grade.

Further investigations and observations on the value of the ammoniacal copper oxid method for the valuation of feeding stuffs, F. Mach (*Landw. Vers. Sta., 95 (1919), No. 1–3, pp. 89–100*).—Further data are reported of the application to feeding stuffs of the method distinguishing between raw and crude cellulose (E. S. R., 43, p. 315). Additional directions are given for the preparation of the cellulose solvent and for the simultaneous estimation of the insoluble crude fiber and the soluble crude cellulose. In the former 100 gm. of twice or thrice recrystallized copper sulphate is dissolved in 500 cc. of hot water made slightly alkaline with ammonia and heated until it no longer smells of ammonia, after which it is decanted six or eight times with hot water, and finally filtered on an asbestos plate and washed with water until the filtrate is almost acid-free. The precipitate is transferred to a flask, dissolved in 2 liters of concentrated ammonia (sp. gr. 0.925), and filtered through asbestos.

In determining insoluble crude fiber and soluble crude cellulose 3 gm. of the sample, rendered fat-free with acetone, is shaken in a flask for 2 hours with 300 cc. of the ammoniacal copper solution, made up to 500 cc. with concentrated ammonia, mixed, filtered on an absbestos filter, and dried after washing with acetone. The funnel is then placed in the suction flask and the entire contents of the shaking flask brought on to the filter, which is finally washed with ammonia and water. For determining the soluble cellulose in the filtrate 50 cc. of the solution is shaken in a shaking flask for 30 minutes with 100 cc. of 90 per cent alcohol added drop by drop, and finally with 25 cc. of concentrated acetic acid, the precipitate filtered on an absestos plate, washed with hot water and acetone, and brought to constant weight.

Present status of fruit and vegetable dehydration, W. V. Cruess (*Chem. and Metall. Engin., 24 (1921), No. 18, pp. 781–785, figs. 2*).—The present status of fruit and vegetable dehydration in the United States is reviewed, the principles and advantages of dehydration are discussed, and a few typical results obtained in experimental dehydration are enumerated.

The purification of beet pulp press water and its application as a yeast food, Reinke (*Deut. Zuckerindus., 46 (1921), Nos. 10, pp. 136–138; 11, pp. 151–153*).—The author suggests the utilization of beet pulp press juice for the growth of yeast, thus making use of the inorganic and nitrogenous constituents of the juice in the preparation of yeast suitable for use as a feeding stuff. The details of the method are presented and discussed.

Possible uses of corncob cellulose in the explosives industry, L. G. Marsh (*Jour. Indus. and Engin. Chem., 13 (1921), No. 4, pp. 296–298*).—Corncob cellulose prepared by the extraction of ground cobs with 1 per cent NaOH solution at 100° C., with subsequent washing and extraction with 4 per cent H_2SO_4 at 100°, was examined for its possible value as a substitute for cotton cellulose. The results of the study indicate "that the only use for corncob cellulose in the explosive industry at the present time is as a carbonaceous absorbent for liquid ingredients, such as nitroglycerin, in the manufacture of dynamite. For that use it must compete with such materials as wood pulp, sawdust, corn meal, charcoal, peanut hulls, rice hulls, and similar materials, all of which have

properties which are advantageous for the manufacture of special grades of dynamite."

Vegetable casein (*Bol. Agr. Indus. y Com. Guatemala, 1 (1921), No. 1, pp. 18–20*).—A brief description is given of the preparation of casein from soy beans.

METEOROLOGY.

Observations on the climate and crop of seasons, 1918, 1919, and 1920, C. R. H[arler] (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1921, No. 1, pp. 28–31*).—The character of the three seasons in the tea district of Assam, especially the relation of rainfall and temperature to the growth of tea, is briefly discussed. The excessive rainfall of 1918 (96.94 in.) and the consequent waterlogging of the soil was reflected in reduced leaf yield at the time and also in its bad effect on the general health of the plants in the following dry season.

"In 1919, the cold weather drought continued well into April, and this accounted for the late start made by the bushes. To the end of July the increase in leaf continued, and then the crop fell off. The cause of this was undoubtedly the dryness of the atmosphere at this time. The normal mean temperature during the hot months in Assam is about 82.5° F. A rise in the mean is almost invariably followed by a fall in crop, not because such a temperature is unfavorable to leaf growth, but because the humidity of the atmosphere invariably falls from about 94, which is the normal, to 75 in this particular case. The drier the atmosphere becomes, the easier is it for the bush to carry out its normal transpiration. When the atmosphere becomes very moist this action can only be carried on by increasing the leaf area. During the period we are considering a fair quantity of rain fell, but mostly at night, so that its full benefit in raising the humidity was lost. The heavy crops obtained at the end of the season were no doubt due to the good rains which prevailed in October, for the results of any peculiarity in the weather are usually most apparent about three weeks after such weather."

In 1920, the early part of the season was too cold and wet, but later dry weather in late May and early June caused a rapid increase in yield. "At the same time, the dryness and hot sun considerably increased the attack of brown blight, which became serious till the rains in the latter part of June modified climatic conditions."

Sunspots and weather, C. E. P. Brooks (*Met. Mag. [London], 56 (1921), No. 665, pp. 113–117; abs. in Nature [London], 107 (1921), No. 2697, p. 599*).—This article reviews and gives a bibliography of the subject, beginning with the claim of Riccioli in 1651 that temperature rose with decreasing sunspots and vice versa, and including the observation by Köppen in 1873 that temperature reaches a maximum shortly before sunspot minimum and a minimum about sunspot maximum.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 8 (1921), Nos. 3, pp. [195], pls. 3, figs. 1; 4, pp. [189], pls. 3, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for March and April, 1921, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and G. E. Lindskog (*Massachusetts Sta. Met. Buls. 391–392 (1921), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

The normal annual precipitation of Tripoli, F. EREDIA (*Agr. Colon. [Italy], 15 (1921), No. 8, pp. 415–421*).—The amount and distribution of the rainfall are discussed. The mean annual rainfall at the observatory of the Royal Agricultural Office of Tripoli, 1892–1920, was 402.7 mm. (15/7 in.), varying from 0.4 mm. in July to 99.4 mm. in December.

The substances dissolved in rain and snow, W. A. MOORE and G. BROWNING (*Chem. News, 122 (1921), No. 3173, pp. 51, 52; abs. in Chem. Abs., 15 (1921), No. 8, p. 1176*).—Rainfall at Mount Vernon, Iowa, during the period from May 31 to August 13, 1920, contained 0.28 part per million of free and albuminoid ammonia, 0.35 part of nitric nitrogen, and 0.23 part of carbon dioxid. No increase in nitrogen was detected during thunderstorms. Traces of phosphates were frequently found. Chlorids were not detected. The first rains in a series were the richest in all constituents.

SOILS—FERTILIZERS.

Rate and extent of solubility of rocks and rock-forming minerals under different treatments and conditions, G. J. BOUYOUCOS (*Michigan Sta. Tech. Bul. 50 (1921), pp. 3–32*).—Studies are reported in which the rate and extent of solubility of a large number of rocks and minerals of alkaline reaction were measured by the freezing point method. An attempt was made to include the most common types of soil-forming rocks and minerals.

The general procedure consisted of first grinding the rocks and minerals to powder passing a 100-mesh sieve. The solubility of this powder was then measured in the leached and unleached condition in distilled water, when treated with salt solutions and washed until all the free soluble salts were eliminated, and in the presence of salt solutions. The moisture content in all cases except one was 1 of solid to 0.75 of liquid. The temperatures employed were room temperature, a temperature of 53° C., and a steam pressure of 26 lbs. which is equivalent to a temperature of about 117°. The materials were contained in glass freezing point tubes of high quality. The freezing point depression was determined immediately upon the powder coming in contact with water or salt solution, once every day thereafter for the first four or five days, and at various intervals thereafter for a long period, in some cases for more than 100 days.

It was found that when very fine powder of rocks and minerals in the unleached condition was mixed with distilled water in the prescribed ratio, the amount of material that went into solution immediately was quite appreciable in all the rocks and minerals, and in some more than in others. The freezing point depression, for instance, varied from 0.008° in quartz to 0.057° in ferruginous sandstone and 0.069° in apophyllite. Expressing these depressions in parts per million of solution, then the concentration varied from 100 parts per million in quartz to 711 in ferruginous standstone and 975 in apophyllite. At a lower moisture content the freezing point depression and, consequently, the concentration, were considerably greater in most of the rocks and minerals.

When the powdered rocks and minerals were leached with distilled water the freezing point depression was greatly decreased in all of them, with few exceptions. At room temperature the rate and extent of solubility of the rocks and minerals, both in the leached and unleached condition, were very small after the initial solubility, even for a period of over 100 days. The increase was only about 0.01° or less at the end of 107 days. With few exceptions, the leached rocks and minerals did not attain the same degree of freezing point depression or concentration of solution as existed before leaching.

In a few rocks and minerals, especially in shale and serpentine, there was a tendency for the initial material in solution to go out of solution, or at least the freezing point depression decreased with lapse of time. This was true mainly at room temperature. At the temperature of 53° for 95 days and at the steam pressure of 26 lbs. for 8 hours, the rate and extent of solubility both in the leached and unleached condition were greatly increased in all the rocks and minerals except in the shale and kaolinite. Thus at the temperature of 53° and in the unleached condition the depression of a biotite granite rose from 0.019 to 0.083°, in pegmatite from 0.025 to 0.137°, in quartzite from 0.02 to 0.132°, and in siliceous sandstone from 0.03 to 0.058°. In the leached condition it rose in amphibole from 0.01 to 0.124°, in chrysolite from 0.005 to 0.22°, in quartz from 0.007 to 0.357°, in serpentine from 0.02 to 0.34°, etc.

The quartz and the quartzites at the higher temperatures gave the highest solubility product with one or two exceptions. The quartz gave a solubility of 0.357°, and the three varieties of quartzite 0.113, 0.132, and 0.152°, respectively. The solubility of shale and kaolinite was not increased by the higher temperatures. The initial depression of shale and of one variety of the ferruginous sandstone decreased even at the highest temperature.

Although at room temperature the solubility of all the rocks and minerals became practically stationary immediately, at the temperature 53° it continued to go on, even at the end of 95 days, without any apparent signs of stopping, and in some of them it progressed with increased velocity. The material which went into solution at the high temperature still persisted when the mass was cooled to —3°, indicating that equilibrium or the saturation point was not yet attained at the high temperature at the end of 95 days. The solubility product of the rocks and minerals at the ratio of 5 of water to 1 of solid was much smaller than that at the ratio of 1 of water to 0.75 of solid at room temperature. At the temperature of 53° it was about the same at both ratios.

The results as a whole point to two outstanding conclusions, namely, that the rocks and minerals employed, with few exceptions, do not show a definite solubility as definite compounds do, and that the equilibrium attained in solubility at the various moisture contents and temperatures is only apparent and not real or absolute.

Treating the rocks and minerals with salt solutions and then washing them until free of soluble salts had very little, if any, effect upon the rate and extent of solubility at ordinary temperature. Even when the salts were allowed to remain in contact with the rocks and minerals for a long time, the solubility was very little, if any, increased at ordinary temperature.

Studies on the reactions between soils and various chemical compounds, C. H. Spurway (*Michigan Sta. Tech. Bul. 51 (1921), pp. 5–29*).—Studies on the reactions between neutral salts, bases, and hydrolyzing salts and alkaline and acid soils of various classes are reported. The procedure consisted mainly in bringing 100 gm. of air-dried soil and 500 cc. of solution into intimate contact at laboratory temperature in glass containers for 1 hour, after which the soil solution was separated by decanting and filtering through paper. The extracts were then analyzed by standard methods.

When solutions of neutral salts were placed in contact with the soils used, the cations of the salts were fixed in the soils, and closely equivalent quantities of calcium and magnesium or other elements previously fixed in the soils by chemical treatments were found in the resulting solutions. When solutions of alkaline salts were used to treat the soils, fixation of one ion was independent of the fixation or combination of the other. Iron was fixed in the soils from ferric chlorid, an acid salt, and a closely proportional quantity of calcium liberated except in case of a soil containing limestone. Anions or

acid radicles of the salts used that form insoluble compounds with calcium or magnesium were fixed by the soils, but similar components that form soluble compounds with these soil elements were not fixed by the soils.

Potassium and calcium were fixed from their hydroxids, but no evidence of exchange of soil elements was observed. In the case of the neutral salt treatments the fixation of potassium correlated with the liberation of calcium and magnesium, and in one series of noncarbonate soils a relationship was observed between fixation of potassium and quantities of calcium and silica dissolved by N/5 hydrochloric acid. The fixation of magnesium correlated with exchange of calcium and fixation of calcium with exchange of magnesium. The fixation of an element was reversed by neutral salts containing other elements in all cases studied except the ferric chlorid treatments.

Potassium, calcium, and magnesium were fixed by natural soils in unequivalent quantities, but when soil calcium and magnesium were largely replaced by a single element, potassium, sodium, or magnesium, then the fixation of the first-named elements became closely equivalent. Soils fixed much greater quantities of calcium from calcium chlorid after being treated with magnesium chlorid than they did before the treatment. With few exceptions, fixation was greater in quantity in alkaline soils than in acid soils of the same class. Fixation from neutral salts is considered to be probably due to a calcium-magnesium-ferro-alumino-silicate, of hydroxids to acid silicates, and from hydrolyzing salts to a combination of these soil components.

Fixation from chemical salts and exchange of soil elements was found to depend upon the manner of dissociation of the salt used for treatments and the solubilities of the compounds formed. The magnitude of fixation and exchange depended upon the quantity relationships between the reacting compounds. There was no evidence of replacement of potassium, sodium, iron, or aluminum in any considerable quantity in the untreated soils studied. Fixation from neutral salts, hydrolyzing salts, or of hydroxids was not a distinguishing characteristic of the acid soils.

Peat and muck soils, M. M. McCool (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 126, 127*).—Studies of the rate of formation of soluble substances in samples taken at different depths from seven different deposits of peat showed that the deposits varied quite widely in this respect. Some were found to be almost inert even when maintained under ideal temperature and moisture conditions, while others proved to be very active. The material comprising the surface 6 in. of each deposit was more active than that at greater depths. These results are taken to indicate that shallow plowing will be more profitable than deep plowing on these soils.

Studies of the effect of a wide range of temperatures on the formation of soluble material in these samples showed that as the temperature rose the rate of formation of soluble salts also increased, in some cases with great rapidity, while in others the samples were much less affected even by quite high temperatures.

Studies of the fixation of soluble phosphoric acid and potash by samples collected from 20 peat and muck deposits showed extremely wide variations in their ability to take up mineral nutrient elements. Usually those with a very low ash content, 10 per cent or less, were found to possess a very small capacity to take up these mineral elements, whereas their capacity increased with their mineral content or their stage of decay. It was also found that deposits that carry a high soluble salt content fixed more phosphoric acid than did those with a low soluble salt content or after the soluble materials had been removed by washing or leaching. This was also found to be the case with several upland or mineral soils.

Soil survey of Morgan County, Ala., A. L. PATRICK ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 46, pls. 2, figs 2, map 1*).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 375,680 acres in northern Alabama, lying within the Appalachian Mountain and Limestone Valleys soil provinces. The county comprises lowland belt, mountain or upland belt, and stream bottom divisions, the topography ranging from flat to gently rolling in the valley sections, from gently undulating to rolling on the plateau tops, and from moderately steep to steep and broken on the mountain slopes. The county on the whole is said to be fairly well drained.

The soils of the county are nearly all of residual origin. Including rough stony land and rough broken land, 26 soil types of 12 series are mapped, of which the Dekalb silt loam, Hanceville fine sandy loam, rough stony land, and Colbert silt loam cover 14, 12.6, 10.8, and 10 per cent of the area, respectively.

Soil survey of Sheridan County, Nebr., F. A. HAYES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 60, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 1,557,120 acres in northwestern Nebraska, lying mainly in the High Plains division of the Great Plains. The topography of the northern half varies from flat to gently undulating in the north-central part to rough and dissected in the northwestern part. The southern half is occupied largely by sand dunes and has a rolling to billowy topography. Drainage is well established except in depressions in the upland and in the flood plains of the larger streams.

The soils of the county are of residual, alluvial, and eolian origin. Including dunesand and rough broken land, 27 soil types of 12 series are mapped, of which dunesand, Valentine loamy sand, and Rosebud very fine sandy loam cover 36.5, 12.1, and 11.8 per cent of the area, respectively.

Soil survey of Fayette County, W. Va., J. A. KERR (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 30, fig. 1, map 1*).—This survey, made in cooperation with the West Virginia Geological Survey, deals with the soils of an area of 426,880 acres in south-central West Virginia, lying wholly within the Appalachian Plateau. The topography is quite rough and mountainous. The upland soils are of residual origin. Including rough stony land and riverwash, 14 soil types of 4 series are mapped, of which the Dekalb stony silt loam, stony loam, and loam cover 27.4, 24.2, and 14 per cent of the area, respectively.

Moor investigations in middle Österbotten, A. L. BACKMAN (*Acta Forest. Fennica, 12 (1919–20), pp. 1–190+1–22, pls. 4, figs. 3*).—This report deals at length with the origin, extent, depth, and general formation of the moor soils of middle Österbotten in Finland, and includes a German summary.

It is stated that from 50 to 55 per cent of the area studied consists of flat moors. Of these about 42.5 per cent are up to 0.5 meter in depth, and only about 11.8 per cent are more than 2 meters deep. In general, the maximum depth increases with the elevation above sea level. It is concluded that these moor soils are due mainly to the overflow of forest soils, and that only a small percentage are of marine origin.

Nitrification in the presence of permutit and carbonates of different alkaline earths, L. WICHERS (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 1–3, pp. 1–9*).—Studies on the influence of the presence of permutit and alkaline carbonates on nitrification of ammonia nitrogen in liquid and sand cultures showed that in liquid cultures the permutit had no influence on nitrification if sufficient lime was present in the solution. On the other hand, there was a favorable influence of permutit on nitrification in sand cultures, especially where strong ammonia additions were used. It is thought that these appar-

ently contradictory results are due to the fact that there were much stronger ammonia additions used in the sand than in the liquid cultures.

Of the alkaline carbonates used magnesium carbonate gave the poorest results, and magnesium nitrate showed direct injury to the nitrifying bacteria. In the order of their effectiveness the alkaline carbonates used were calcium, barium, strontium, and magnesium.

[Soils], G. L. SCHUSTER (*Delaware Sta. Bul. 126 (1920), pp. 9–12*).—Data on soil fertility studies are said to indicate that phosphoric acid and potash have given the most marked and profitable results in increasing wheat crops, and that potash is one of the limiting elements of the Sassafras silt soil. Liming has been markedly beneficial to hay and corn, especially on acid soils. The benefits of lime on soy beans seem to be uncertain without the presence of other plant nutrients.

The crop rotation studies have shown that the yields of corn in a rotation that includes red clover are much higher than where corn, soy beans, and timothy are rotated. It is also noted that red clover, corn, and soy beans demand potash. In a 4-year rotation of corn, wheat, and alfalfa for two years, the yields of corn following alfalfa have been larger than where 700 lbs. of commercial fertilizer were used in connection with a rotation of corn, soy beans, wheat, and red clover.

Studies made on the relative value of the various forms of lime, including several carriers of phosphoric acid, while apparently not conclusive as yet, thus far indicate that there is little difference in the form of lime used. On the other hand, the results with carriers of phosphoric acid indicate that acid phosphate is more effective than any other carrier, followed in order by basic slag, bone meal, and raw rock phosphate.

Some biological changes brought about in certain Delaware soils by different cropping, fertilizers, liming, and manurial treatments, T. F. MANNS (*Delaware Sta. Bul. 126 (1920), pp. 23, 24*).—Studies on some 50 samples of soil from different parts of Delaware showed that from the bacteriological standpoint all soils with one exception were improved by meeting the lime requirement. On this soil (Chester loam) not only the beneficial bacteria were decreased by liming but the yield of clover was decreased. In several cases manuring alone produced a detrimental flora, particularly in sandy soils. In general, liming was found to increase nitrifying and nitrogen-fixing bacteria, and large applications of manure increased the ammonifying bacteria, especially the *Bacillus subtilis* group.

Fertilizer experiments on the experimental plats, C. VAN ROSSEM (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Alg. Proefsta. Landb., No. 6 (1920), pp. [2]+31*).—A number of different fertilizer material studies are reported.

The use of sulphuric acid in amounts equivalent to that in 88, 176, and 238 lbs. of ammonium sulphate per acre had no evident influence on the crop of rice. Two tests of the multiple application of superphosphate to rice showed that fertilization in three and four applications was more profitable than one and two applications.

Four similar tests with ammonium sulphate showed that fertilization in four applications was more profitable than fertilization in one, two, or three applications. Good results were obtained from fertilizing rice with calcium carbonate. Chilean nitrate in combination with superphosphate gave more favorable results with rice than ammonium sulphate in the same combination.

Manuring of pastures for meat and milk, W. SOMERVILLE (*Min. Agr. and Fisheries [London], Misc. Pub. 30 (1921), pp. IV+32*).—Considerable data from English experiments on the manuring of pastures are summarized to show that

the basis of all pasture improvement is phosphoric acid. The data indicate that basic slag has proved better and cheaper than superphosphate or dissolved bones, but that other phosphates worthy of trial are precipitated phosphate and very finely ground raw mineral phosphates.

The best results were obtained by liberal applications of slag in the first instance, supplemented by smaller applications every three or four years. It was found that slag may be successfully applied to pasture in any month of the year. In the great majority of cases slag alone is all that is necessary. Nitrogen in any form is considered to be objectionable, and it has been found that only in rare instances does it pay to use potash. Phosphates show a marked residual effect for many years when used on pasture. Pastures treated with slag were found to have a prolonged grazing season. Cake fed to stock grazing land that had previously been improved by phosphate represses clover and produces a coarse unpalatable herbage. It proved to be a poor agent in maintaining the fertility produced by slag, and its use was extremely unprofitable when used on pasture that has been treated by slag.

Changes in stable manure and methods for their prevention, W. H. Wisselink (*Tijdschr. Nederland. Heidemaatsch., 33 (1921), No. 3, pp. 81–92*).—Several experiments are described indicating the losses of nutritive constituents, especially nitrogen, from stable manure during storage by evaporation, rotting, and leaching, and information is given on the use of conserving materials such as old manure, sulphuric acid, acid salts, neutral salts, lime compounds, and peat.

While sulphuric acid is quite effective in preventing nitrogen losses, it is considered to be dangerous for animals and for the user, and it also destroys the carbonaceous matter in the manure. The placing of old manure at the bottom of the manure pit and covering it with a layer of fresh manure has been found to be effective in preventing nitrogen losses from the latter. The carbon-dioxid gas formed by the old manure escapes through the new manure and excludes air. Part of the carbon dioxid is said to also combine with the ammonia of the new manure, forming ammonium carbonate.

Productive soil used in considerable amounts was also found to prevent nitrogen losses. Peat litter was not specially active in absorbing ammonia, and the opinion is expressed that measures should be taken to prevent the evaporation of ammonia from peat litter manure.

Nitrogen fertilization experiment, 1904–1920, in Petkus, Laube (*Deut. Landw. Presse, 48 (1921), No. 6, pp. 37, 38*).—An experiment on loamy sand soil, extending from 1904 to 1920, in which both root and above-ground crops were fertilized with nitrogen, the former with lime marl and stable manure and the latter with kainit and Thomas meal, showed that nitrogen is the limiting fertility factor in these soils.

Phosphoric acid fertilization, Schneidewind (*Deut. Landw. Presse, 47 (1920), No. 97, pp. 659, 660*).—A 4-year study on normal German soils showed that the amount of residual phosphoric acid resulting from treatment with stable manure alone was small, but was nearly eight times as much where superphosphate was used alone, and where stable manure and superphosphate were used together it was twice as much as where superphosphate was used alone.

A 7-year study in which Thomas meal and superphosphate were applied in bulk at the beginning and in equal annual amounts indicated about the same recovery of phosphoric acid for each method of treatment. This is considered to be proof of the residual action of phosphoric acid fertilization.

Stable manure was found to be an active phosphoric acid fertilizer, but superphosphate was apparently not nearly so active on manure-treated plats

as where used alone. This was found to be more the case for potatoes than for the other crops, and it is concluded that with a one-sided fertilization with stable manure or superphosphate crop yields will be depresseed in later years more in the case of potatoes than of wheat, barley, and sugar beets. This is apparently attributed largely to the poorer utilization of phosphoric acid by potatoes than by the other crops.

Action of rain water on the water-insoluble phosphoric acid of Thomas slag, A. NEMEC and F. ZLABEK (*Deut. Landw. Presse, 48 (1921), No. 12, p. 82*).—A brief experiment is reported which showed that when Thomas slag was exposed to the action of a heavy rain storm there was a decrease in citrate-soluble phosphoric acid and an increase in water-soluble phosphoric acid. This is attributed to the action of the carbon dioxid in the rain water.

Importance of potash salts for moor cultivation in Finland, compiled by A. RINDELL (*Ernähr. Pflanze, 17 (1921), No. 5–6, pp. 25–30, figs. 2*).—A number of experiments on the use of kainit and 37 per cent potash salts on the moor soils of Finland are summarized and discussed.

Kainit generally gave better results than the 37 per cent salts except with potatoes. Potash fertilization was most profitable with root crops, followed in order by grain crops, meadow grasses, and legumes. The Finnish cultural method of mixing loam and sand with moor soils did not interfere with the profitable use of potash. Proper regulation of soil moisture was found necessary for the best results with potash on these soils.

The action of sodium in the presence of potassium as a plant nutrient, T. PFEIFFER, A. RIPPEL, and C. PFETENHAUER (*Jour. Landw., 68 (1920), No. 4, pp. 255–284*).—A number of experiments are reported which showed that sodium salts may to some extent replace potassium salts as nutritive material for oats. In the production of dry matter the sodium is said to replace potassium in the molecular ratio of 0.25 : 1. When relatively small quantities of potassium and relatively large quantities of sodium are present, this ratio is increased to 0.38 : 1. When such replacement occurs the sodium appears not only in the leaves and stems but also in the grain.

The liming of soils, C. W. SIMPSON (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 124, 125, fig. 1*).—Investigations at Cassopolis, Mich., begun in 1916 on the value of limestone of different degrees of fineness of grinding, hydrated lime, and marl on sandy soils showed that the stand and thriftiness of the sweet clover plants varied with the fineness of the limestone. The best results were obtained on land receiving either the finely ground limestone, hydrated lime, or marl. Better results were also obtained where phosphate and potash fertilizers were added with the limestone.

Further experiments indicated the benefits of applications of lime or marl somewhat before the time of seeding, especially upon acid soils.

Does liming also effect carbon dioxid fertilization? A. GEHRING (*Deut. Landw. Presse, 47 (1920), No. 103, pp. 709, 710, figs. 3*).—The author reviews the work of others and reports the results of experiments, from which he concludes that the fertilizing action of carbon dioxid produced by the liming of soils, especially in the presence of sufficient organic matter, is of considerable extent.

Lime and magnesia experiments, D. MEYER (*Landw. Jahrb., 55 (1920), No. 1, pp. 46–61*).—Four years' experiments on the action of different forms of lime, including burned lime, pure calcium carbonate, limestone meal, and by-product lime, on mustard and horse beans in a sandy loam soil deficient in lime showed that with mustard the increases in yield produced by lime were small. The best results were given by calcium carbonate and the poorest by the by-product lime. With horse beans the best results were given by limestone meal,

followed in order by burned lime, calcium carbonate, and by-product lime. When mustard and horse beans were grown in the same year (the latter as a cover crop), the effect of lime was greater for mustard than for the beans. This is attributed largely to the late planting of the beans. In general, the by-product lime was not as effective as the other three forms of lime, it being on the average only about 82 per cent as effective as calcium carbonate and limestone meal. The burned lime was about 95 per cent as effective as these two. The lower effectivenss of the by-product lime is attributed partially to its calcium chlorid content.

Studies of the effect of different lime-magnesia ratios on the yield of different crops and of the relative effectiveness of burned lime and burned magnesia are also reported. The lime-magnesia ratios in the soil favored by Loew for grains and legumes were found not to be the best for a small number of crops in these experiments. In a soil apparently well supplied with lime, but which contained 3.5 times as much magnesia as lime, variation of the lime content did not increase the oats yield, but fertilization with magnesite and magnesium sulphate, resulting in a lime-magnesia ratio of 1:6, effected an increase. The yield of horse beans was not influenced much by additions of magnesium sulphate. Magnesite caused a decrease in yield, but much less so than additions of calcium carbonate resulting in a lime-magnesia ratio of 3:1.

The development of root nodules on beans was best in soil fertilized with magnesium sulphate and the poorest in soils with a lime-magnesia ratio of 3:1.

Four years' fertilization with burned lime and burned magnesia in annual amounts of about 4,000 kg. per hectare (3,560 lbs. per acre) showed a marked injury to crops by the burned magnesia after the third year. This is attributed to the strongly alkaline reaction caused by the magnesia. It was found that the lime-magnesia ratio in plants can vary widely without hindering the development of the plant. A higher magnesia than lime content produced by one-sided magnesia fertilization did not injure oats.

It is concluded that the practical use of burned dolomitic lime is mainly dependent upon the physical and chemical condition of the soil and upon its need for lime. The heavier the soil and the greater its content of acid reacting substances the larger are the permissible lime-magnesia applications, and vice versa. Pure burned lime and burned lime containing magnesia should not be used on sand soils. The magnesia of dolomitic limestone and marl did not show the injurious action of the burned magnesia.

Studies on degrees of fineness of lime fertilizer indicated that limestone meal and pulverized lime marl should contain at least 70 per cent of fine meal passing a No. 100 sieve. That part retained on a No. 100 sieve and which passes a No. 50 sieve should have a value not higher than 75 per cent of that of the fine material, and that part retained on a No. 50 sieve and which passes a 1 mm. round-hole sieve should have a value of only from 25 to 50 per cent of the fine material. Particles greater than 1 mm. should be discarded. Damp, earthy lime marl should be dried and ground before use.

Sulphur for neutralizing alkali soil, P. L. Hibbard (*Soil Sci., 11 (1921), No. 5, pp. 385–387*).—Chemical and cropping experiments conducted at the California Experiment Station are reported, which showed that sulphur added to a soil soon becomes sulphuric acid which reacts with and neutralizes whatever alkaline material may be present. The opinion is expressed that this effect should be of great value in the reclamation of alkali land.

The influence of fertilizers containing borax on the yield of potatoes and corn, season 1920, A. W. Blair and B. E. Brown (*Soil Sci., 11 (1921), No. 5, pp. 369–383, figs. 8*).—Experiments conducted at the New Jersey Experiment Stations with potatoes and corn on Sassafras loam soil to determine the

influence of anhydrous borax applied in a control fertilizer at rates of 1, 2, 3, 4, 5, 10, 20, 50, 100, 200, and 400 lbs. per acre are reported.

Where the borax was applied in the furrow two or three weeks before planting there was little or no decrease in yield with as much as 50 lbs. of borax per acre. With an application of 100 lbs. of borax per acre the yield of potatoes was cut to about one-half the normal, and with 200 lbs. of borax to about one-fourth the normal. Where the borax was drilled in the furrow at the time of planting there was no distinct depression in the potato yield until the 30-lb. application of borax was reached, but the 50-lb. application reduced the yield to about one-third normal. Where the borax was broadcast at the time of planting the 30-lb. application did not reduce the potato yield, but beyond this amount there was a depression amounting to total failure with the larger applications.

Where the borax was broadcast and applied in the furrow at the time of planting of corn, germination was depressed with applications as low as from 5 to 10 lbs. per acre. Where the borax was applied in the furrow two weeks before planting, depression of germination occurred with 20 lbs. per acre for hill planting and with 30 lbs. per acre for interhill planting, but there was no definite depression in yield with applications up to and including 50 lbs. of borax per acre. When drilled in the furrow at the time of planting the depression in yield of corn began with the 10-lb. application of borax and when broadcast the depression began with the 4 and 5-lb. applications.

Inspection of commercial fertilizers, 1920 (*New York State Sta. Bul. 480 (1920), pp. 3–59*).—This bulletin contains the results of actual and guarantied analyses of 677 samples of fertilizers and fertilizer materials collected for inspection in New York during 1920.

AGRICULTURAL BOTANY.

Report of the department of plant physiology, E. M. R. Lamkey (*Delaware Sta. Bul. 126 (1920), pp. 27, 28*).—In continuation of experiments previously reported (E. S. R., 44, p. 424), the author briefly describes the results of investigations on the changing permeability in the peach. It has been found that the use of commercial fertilizers in various combinations and amounts has resulted in a variable and selective permeability within the peach, not only toward the salts used as fertilizers but toward other salts used as standard tests and toward organic compounds found in the tissues themselves. Further studies are said to show the influence of the anion of a compound upon permeability, and under proper conditions it has been found to have more effect upon a change in permeability than the influence brought about by a change in the cation of the compound.

Investigations made with field corn and garden peas to determine the enzymactic activity as a limiting factor in production are said to indicate in the case of corn that vigor, productivity, and food content appear closely related to reduction and oxidation processes of an enzymatic nature. With one variety of peas it was found possible to predict failure of a strain to come to maturity or even to germinate.

Weber's law in plant physiology, P. Stark (*Ztschr. Allg. Physiol., 18 (1920), No. 3–4, pp. 371–448, figs. 4*).—Giving an account, with discussion, of the methods and results of experimentation dealing with tropisms of plants throughout a wide systematic range, the author states that Weber's law was found to hold in numerous cases.

Electro-osmotic phenomena and their significance in plant physiology, K. Stern (*Ztschr. Bot., 11 (1919), No. 11, pp. 561–604, figs. 5*).—Data and infer-

ences are detailed as derived from a study of the behavior of water in soil and plants under the influence of electrical charges.

Researches on growth of plants, I, II, J. C. Bose (*Nature [London], 105 (1920), Nos. 2646, pp. 615–617, figs. 3; 2647, pp. 648–651, figs. 3*).—From these experiments with the crescograph, a more extended account of which has been noted (E. S. R., 41, p. 724), the generalization was obtained that all forms of stimuli, mechanical, electrical, or radiational, induce a retardation of the rate of growth. Subminimal stimulus induces acceleration of growth instead of retardation.

The various movements of plants are explained in some detail, but all are referred to the general law that direct stimulus induces contraction while indirect stimulus causes expansion.

Slow and rapid growth, H. S. Reed (*Amer. Jour. Bot., 7 (1920), No. 8, pp. 327–332, figs. 2*).—Observations and mathematical analyses appear to show that growth rate in shoots depends upon the final length, so that causes influencing ultimate length influence growth rate. The close correspondence between observed shoot growth rate and equations presented is taken as evidence that growth is in some way a catalytic process. The organism may thus be considered as the end product of a process in which a catalyst acts upon a substrate.

The growth curve of plants, A. Rippel (*Landw. Vers. Sta., 97 (1921), No. 5–6, pp. 357–378, fig. 1*).—A theoretical presentation follows critical discussion of other contributions.

The growth of the sugar cane, C. A. Barber (*Internatl. Sugar Jour., 21 (1919), Nos. 250, pp. 506–510, figs. 12; 251, pp. 545–548, pls. 2; 252, pp. 601–603, pls. 2; 22 (1920), Nos. 254, pp. 76–80, pls. 2, figs. 2; 256, pp. 198–203, pls. 2; 258, pp. 313–317, fig. 1; 259, pp. 371–375, pls. 2, fig. 1; 260, pp. 442–446, pls. 2, fig. 1; 261, pp. 495–498; 262, pp. 548–551, pls. 2*).—In this series the various aspects of development in the sugar cane plant have been reviewed.

Considerable attention is paid to the underground stage of growth. It is shown that the branching system of the cane can be expressed by a formula which becomes more and more simplified in a review of the various groups of indigenous Indian canes, reaching the extreme of simplicity in the ordinary canes of tropical countries.

Study of leaf, stem, and leaf sheath showed no two of these parts to be growing in length at the same time, this fact suggesting that only a certain amount of growing energy is available and that this is manifested by the different organs in succession. The leaf elongates first and the sheath extends itself later, this sequence being followed by the stem which commences to grow in length after the leaf sheath has fully developed. The length and thickness of the mature cane have been studied in different varieties and the effects of external conditions have been noted; the whole question of tillering has been dealt with, and the results of previous studies on this subject have been summarized. The factors which influence growth in all these directions and which play such a considerable part in the tonnage of canes at harvest have been analyzed. Consideration of the large series of measurements made led to the belief that none of the vicissitudes experienced by a plantation during the growing season fails to leave its mark permanently on the size and form of the cane and its appendages.

Hydration and growth, D. T. MacDougal (*Amer. Phil. Soc. Proc., 58 (1919), No. 6, pp. 346–372, figs. 3*).—A more detailed account of studies having the same title has been noted (E. S. R., 43, p. 428).

An apparatus for determining small amounts of carbon dioxid, R. C. Wright (*Amer. Jour. Bot., 7 (1920), No. 9, pp. 368–370, fig. 1*).—Certain inves-

tigations carried on by the Bureau of Markets, U. S. Department of Agriculture, in connection with the storage of fruits and vegetables require a simple and rapid method of determining small quantities of carbon dioxid in the air of both common and cold storage plants. The author describes a volumetric apparatus said to be light, portable, convenient as to size, and so simple in construction that it can be used by an unskilled operator. A description is given of the method of operating the carbon dioxid apparatus.

The artificial cell, R. KOLKWITZ (*Ber. Deut. Bot. Gesell., 38 (1920), No. 3, pp. 136–140, fig. 1*).—A comparatively simple piece of glass apparatus is discussed as to its applicability and use in different sorts of experimentation bearing upon forces and processes observable in connection with plant cells.

Fluorescence and the condition of chlorophyll in living cells, K. STERN (*Ber. Deut. Bot. Gesell., 38 (1920), No. 1, pp. 28–35*).—Chlorophyll fluoresces freely in true solution, not so freely in colloidal solutions or in a fixed state. The accurate quantitative determination of fluorescence requires spectroscopic study, as the unaided eye is untrustworthy for this purpose. Chlorophyll in the intact cells is found in lipoid, true, and fluorescent solutions. Assimilation goes on partly in lipoid, partly in hydroid, phase. Superficially active substances may alter the limiting surfaces of both phases and thereby limit or inhibit assimilation.

Structure and behavior of lenticels, F. W. NEGER and T. KUPKA (*Ber. Deut. Bot. Gesell., 38 (1920), No. 3, pp. 141–149, figs. 6*).—A brief account is given of observations made on lenticels of certain conifers.

Size of chloroplasts, M. MÖBIUS (*Ber. Deut. Bot. Gesell., 38 (1920), No. 6, pp. 224–232*).—Results of measurements of chloroplasts in members of a large number of families are given in tabular form with discussion.

The secretion of invertase by plant roots, L. KNUDSON (*Amer. Jour. Bot., 7 (1920), No. 9, pp. 371–379, fig. 1*).—Evidence is presented to show that the Canada field pea (*Pisum arvense*) and corn (*Zea mays*) grown in the presence of sucrose cause an increase of reducing sugars in the culture solution. The reaction of the culture solution is such as to be without influence on the sucrose. Invertase does not appear to be present. It is thought that the increase in reducing sugars is due to their excretion from the roots.

Measurement of the catalytic power of catalase, L. G. M. B. BECKING and H. C. HAMPTON (*Amer. Jour. Bot., 7 (1920), No. 7, pp. 261–274, figs. 6*).—A brief account of a new principle and method of determining the rate of catalase action. A review of related literature points out inaccuracies and other drawbacks of methods previously employed. The autographical method offered is said to be adapted to determine the strength of a peroxid solution. The method shows evidence of two successive reactions, the two catalases involved probably being different degrees of peptisation of the same substance. The enzym is more or less destroyed during the reaction.

Assimilation of nitrogen, phosphorus, and potassium by corn when nutrient salts are confined to different roots, P. L. GILE and J. O. CARRERO (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 545–573, fig. 1*).—In a contribution from the Porto Rico Experiment Station the authors give additional data on the assimilation of nutrient salts by corn. The present paper, which supplements a previous account (E. S. R., 37, p. 222), reports work which shows how the assimilations of nitrogen, phosphorus, and potassium were affected when half the roots of the plant were in a complete nutrient solution and half in a solution lacking more than one essential element; when the roots were divided between two solutions, each of which lacked one or two elements; and when the roots were divided among three solutions, each of which lacked one

or two elements. Only nitrogen, phosphorus, and potassium were varied in these tests.

It was found that depressions in growth and assimilation of the nutrients were roughly proportional to the incompleteness of the solutions afforded the roots. Assimilation did not diminish with increasing subdivision of the roots among different solutions, unless the division entailed increased localization of the supply of the various nutrients. The more growth and assimilation were depressed by division of the roots among incomplete solutions the higher was the rate of root growth to top growth. However, the relation between diminution in assimilation and increase in the root to top ratio was not quantitatively proportional.

When different portions of the roots were supplied with different nutrient solutions, the roots in the more complete solutions generally made the greater growth and had a more bushy habit of growth. In the solutions lacking two elements the main roots were longer than in the more complete solutions, and the lateral roots were fewer and farther apart on the main root. When the roots were divided between solutions lacking in the same number of nutrients, root growth was greatest in the solution containing nitrogen. The relative, as well as the absolute, root growth made in any solution was found to depend on the character of the solution in which the remainder of the roots were growing.

When the roots were divided among three incomplete solutions, each of which lacked either one or two of the elements nitrogen, phosphorus, and potassium, nitrogen assimilation approached the normal assimilation more nearly than did the potassium assimilation, and potassium was assimilated to a slightly greater extent than phosphorus.

A study of rhinanthocyan, A. NESTLER (*Ber. Deut. Bot. Gesell., 38 (1920), No. 3, pp. 117–121*).—Seeds of *Alectorolophus hirsutus* are said after trituration with 70 per cent alcohol and 5 per cent hydrochloric acid to give quickly at 70° C. a clear blue color, due to the fact that the extracted glycosid rhinanthin splits into sugar and rhinanthocyan. The further study of this component is briefly outlined.

Recent studies on phototropism and geotropism, H. SIERP (*Ztschr. Bot., 11 (1919), No. 10, pp. 510–537*).—This is a synthetic review of a number of recent contributions cited regarding tropisms.

Monocotyledons and dicotyledons showing the same vascular type, G. CHAUVEAUD (*Bot. Soc. Bot. France, 66 (1919), No. 8–9, pp. 373–381*).—The author notes the occurrence, in monocotyledons and dicotyledons, of the same developmental phases and the same order of their succession. The facts are discussed as to their bearing upon relationships.

Color and sex in flowers, L. BLARINGHEM (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 20, pp. 892, 893*).—Changes in floral coloration said to bear a definite relation to the sexual evolution of each flower are noted as the result of observations on *Dianthus barbatus*.

Variations in sexuality in the Compositae, L. BLARINGHEM (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 25, pp. 1060–1062*).—Sexual anomalies indicated in Centaurea are attributed to hybridization between closely related species.

Xenia in chestnut, L. BLARINGHEM (*Bul. Soc. Bot. France, 66 (1919), No. 8–9, pp. 354–356*).—The author describes what is considered a case of xenia in chestnut, but of a type different from that described by him in 1913 (E. S. R., 30, p. 235).

The breeding of tea plants, C. P. C. STUART (*Ztschr. Pflanzenzücht., 7 (1920), No. 3, pp. 157–204, figs. 8*).—This is a comparative study of types of tea plants with reference to desirable qualities.

Reversion in African bananas, E. DE WILDERMAN (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 23, pp. 1002–1004*).—An account, with suggestions, is given of regression in male flowers of the Mayomba banana, further study of which is suggested as desirable.

A natural grouping of bacteria, O. RAHN (*Centbl. Bakt. [etc.], 2. Abt., 50 (1920), No. 13–19, pp. 273–293, figs. 2*).—Systematization methods as ordinarily used with the higher plants have given less satisfactory results when applied to bacteria. This is due largely to the greater number still remaining of intermediate and transition forms in the bacteria. In this work the author has attempted to make greater use of resemblances rather than to emphasize differences.

[Uric and hippuric acid bacteria], C. STAPP (*Centbl. Bakt. [etc.], 2. Abt., 51 (1920), No. 1–4, pp. 1–71, pl. 1, figs. 7*).—An account is given of a study applied to bacterial species supposedly new, which are said to be able to subsist with uric or hippuric acid as sole organic nutrient.

FIELD CROPS.

Crop production in western Canada, J. BRACKEN (*Winnipeg: Grain Growers' Guide, Ltd., 1920, pp. XXVI+423, figs. [164]*).—"An outline of the crop practices now followed by the leading farmers in many parts of the West, together with a discussion of the purposes of these practices and suggestions for modification of them where soil and climatic conditions demand a different procedure." The author discusses in detail in this book the importance of good seed, choice of crops, and the principles underlying plant growth, and treats at some length of the factors and practices involved in the production and marketing of wheat, oats, barley, rye, corn, flax, peas, forage crops, root crops, and potatoes. Common insect pests and their control and important diseases of the potato are discussed in separate chapters.

Dry farming in western Canada, J. BRACKEN (*Winnipeg: Grain Growers' Guide, Ltd., 1921, pp. XXI+386, figs. 116*).—The book purposes to present "a more or less complete statement of our present knowledge concerning the methods of producing crops at a profit under relatively dry conditions." The successive chapters treat of the development of dry farming, the climate of western Canada in its relation to crop production, the soil, the moisture problem, dry farm crops and cropping practices, the principles of tillage, breaking the virgin prairie, preparing park belt land for its first crop, tillage of stubble land, summer fallow, crop rotations, weeds and their control, irrigation farming in western Canada, causes and control of low yields, management of special soils, lessons from experience, and the problem of crop production.

[Report of field crops work in Ontario, 1919] (*Ontario Min. Agr. Rpt., 1919, pp. 6, 7, 22, 59–61, 69–72, 76, 77*).—Variety and improvement work with cereals, comparative tests of potatoes on clay and sandy soils, and demonstrations with various field crops are reported in continuation of similar work (E. S. R., 42, p. 229).

Average acre yields of grain of oat varieties grown without change of seed for the past 30 years and for the past 5 years, respectively, were as follows: Siberian, 89.4, 87.7; Probsteier, 86.4, 89.4; Oderbrucker, 85.9, 87.1; Waterloo, 84.8, 84.8; Bavarian, 84.1, 90.7; Joanette, 83.3, 75.1; Egyptian, 76.4, 78.4; and Black Tartarian, 70.1, 72.8 bu. The yield for the last 5 years was less than that for the whole 30-year period in only two instances. For decided increases in

grain production other methods than frequent and indiscriminate change of seed are deemed necessary.

Crop rotations for Missouri soils, R. R. HUDELSON and C. A. HELM (*Missouri Sta. Bul. 183 (1921), pp. 27, figs. 11*).—A discussion of the beneficial effects of crop rotations on yields, soils, labor income, and in control of weeds, plant diseases, and insects. Crops included in rotations and their sequences are noted, and methods of handling the rotation are outlined. Rotations are suggested for different types of farming on the several soil types in the State. Field experiments extending over 30 years and comparing the values of different rotations have been noted (E. S. R., 45, p. 517.)

[Field crops work in Porto Rico in 1920], D. W. MAY, T. B. MCCLELLAND, and W. V. TOWER (*Porto Rico Sta. Rpt. 1920, pp. 11, 12, 15, 16, 25, 26, pls. 2*).—Of the forage crops tested, velvet beans, sunn hemp (*Crotalaria juncea*), and elephant grass are considered worthy of extensive culture. The last named grows on low and high land, can be cut several times during the year, and yields enormously. A recent cutting from a stand 4 years old produced 12.8 tons per acre, and a plat on high land, first cut 7 months and 10 days after planting, yielded at the rate of 19.3 tons per acre. Japanese cane, wholly immune to mosaic disease and extensively planted for sugar, is also regarded as valuable for forage.

Trials of bean varieties showed that generally, under favorable conditions, varieties previously grown in the Tropics are much more dependable than importations from the North. Work with selections of Venezuelan black beans and pigeon peas is also noted.

In tests of legume cover crops, sunn hemp, *Stizolobium velutinum*, *S. aterrimum*, bush velvet beans, and *Canavalia ensiformis* made calculated acre yields of 12.6, 9, 8.8, 7.5, and 5.4 tons green weight, respectively, which after drying 25 days were reduced to 3, 1.3, 1.4, 1.4, and 1 tons, respectively. Sunn hemp planted among citrus trees produced 11.93 tons green weight, of stems and leaves, and 1.69 tons of roots, or a total air-dry weight of 2.84 tons per acre. When topped at 12, 24, 30, and 42 in. in height and the branches which subsequently developed cut when the plants were 8.5, 9, 9.5, and 10.25 ft. high, respectively, the acre yields of branches were 10.7, 22.5, 23.9, and 27.8 tons green weight, respectively, compared with 29.6 tons from plants not topped. Insects and snails attacking sunn hemp are also noted.

[Field crops work in Argentina, 1918–1920,] M. MONTANARI, F. REITCHERT, and F. P. MAROTTA (*Rev. Facult. Agron. y Vet. Buenos Aires, 3 (1920), No. 2, pp. 156–204*).—These pages report the results of experiments conducted by the experiment station at Buenos Aires during the crop years 1918–19 and 1919–20, including variety tests with wheat and brewing barley; cultural tests with wheat and corn; size of seed and fertilizer tests with potatoes; and field trials with sugar beets, Sudan grass, perennial sorghum, *Phalaris bulbosa*, and alfalfa.

Effect of the length of day on seedlings of alfalfa varieties and the possibility of utilizing this as a practical means of identification, R. A. OAKLEY and H. L. WESTOVER (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 599–608, pls. 11*).—Observations by the Bureau of Plant Industry, U. S. Department of Agriculture, in the approximate latitude of Washington showed that seedlings of different varieties of alfalfa seeded in the early fall or grown in the greenhouse from December seedings developed characteristics that make possible for the casual observer to easily distinguish one variety from another, whereas seedlings from spring seedings did not develop differences at Washington or in northern latitudes in the United States that would be apparent to the untrained eye.

In greenhouse experiments, where alfalfa varieties planted on January 20 were subjected to the effect of a normal day, a shortened day, and a lengthened day, respectively, the seedlings grown under the normal and the shortened day behaved essentially the same as those from early fall seedings at Arlington. In height, erectness, and lack of branching the varieties ranked as follows: Peruvian, Kansas, Grimm, Turkestan, *Medicago falcata*. Seedlings under the lengthened day showed striking differences between the varieties, but behaved in practically the reverse order from those under the normal and the shortened day. At the end of the first month the seedlings of *M. falcata* and Grimm exceeded those of the Peruvian and Kansas varieties in height, and were quite as erect and unbranched. These results led to the conclusion that the observed differences in the seedlings were due to their day and night relation and not to their reaction to temperature.

The tests can be so quickly and easily made that the following method is offered especially to experiment station workers and those engaged in alfalfa seed certification work for use in the identification of various lots of seed. The seed to be identified are sown in rows in small flats in which adjoining rows are seeded with Peruvian, Kansas, or some southern-grown common strain, Montana, Dakota, or some northern-grown common strain, Grimm, and a strain of *M. falcata*. For the best results there should be three flats sown in like manner—one to be subjected to a short day, another to an abnormally long day, and the third to the normal day as it exists at the time the tests are made. The normal day series may not be necessary, but there are some advantages in including it as a control. It is suggested that the day be shortened for the first series by keeping it in total darkness from 4 p. m. until 9 a. m. This gives a day sufficiently long for the necessary photosynthetic action and at the same time short enough to produce quick and striking differences in the seedlings of at least certain of the varieties. The length of day may be augmented for the second series by using a tungsten bulb of 100 watts with a reflector. The light may be turned on at dusk and turned off about 11 o'clock p. m. Although this gives an abnormally long period of constant illumination, such a period is helpful in producing striking results quickly. By the use of both the short and the long day the differences between the northern and southern alfalfas are better shown. The normal-day series adds evidence when the differences of the seedlings are studied.

Alfalfa production under irrigation, G. STEWART (*Utah Sta. Circ. 45 (1921), pp. 3–48, figs. 13*).—This circular relates the history and present condition of alfalfa; describes the plant, its adaptation, and varieties; details the operations in growing the crop under irrigation; and outlines the practices involved in hay making and seed production. Instructions are given for the control of weeds and the alfalfa weevil, and the utilization of the crop for seeding, pasturing, and for market hay is discussed.

The experimental basis for the present status of corn breeding, F. D. RICHEY (*Science, n. ser., 53 (1921), No. 1371 p. 344*).—A review of experimental efforts to increase corn yields by breeding led to the following conclusions:

Mass selection on the basis of production of mature, sound grain per plant, under conditions of uniform stand and fertility, may be recommended as a means of at least maintaining yields. There is no evidence that ear-to-row breeding can be relied upon to obtain increased yields commensurate with the cost. First generation varietal crosses, and crosses or double crosses between pure lines, offer possibilities for obtaining larger yields; but the value of each combination must be determined experimentally. The value of selection in obtaining better adaptation to a specific environment and the value of hybrid vigor in obtaining larger yields is shown clearly. "These principles, in connec-

tion with the Mendelian interpretation of heterosis as due to linked dominant growth factors, point to selection, hybridization, and further selection, all based on pure lines and controlled pollination, as the only sound basis for real corn improvement."

First generation corn varietal crosses, F. GRIFFEE (*Science, n. ser., 53 (1921), No. 1371, p. 346*).—The development of the theory which accounts for the increased vigor of F_1 crosses, and experiments in which F_1 corn crosses are compared with their parents for grain yield, were reviewed. Of 146 crosses, 113 exceeded the parental average in yield of grain and 84 exceeded the better parent.

At the Minnesota Experiment Station 5 flint-dent crosses tested for a period of two to six years averaged 7.7 per cent more shelled corn per acre than either parent. A cross between Minnesota No. 13 and Squaw Flint gave 8.4 per cent more shelled corn per acre and matured a week to ten days earlier than Minnesota No. 13, the higher yielding parent. In the crosses with Minnesota No. 13, the increase in yield of shelled corn per acre of the F_1 cross over the better parent averaged less for the last two years, where Minnesota No. 13 was selected primarily for yield, than for the first four years of the tests when selection for type was followed. This apparently indicated that, if corn were selected primarily on the basis of yield, the value of F_1 varietal crosses would be somewhat questionable.

Corn in Missouri.—II, Field methods that increase the corn crop, C. A. HELM (*Missouri Sta. Bul. 185 (1921), pp. 3–20, figs. 3*).—The functions of soil fertility; seed bed preparation; time, rate, and methods of planting; cultivation; and intertilled catch crops as factors in increasing the yields of corn are set forth, and results of experiments involving these factors are reported. Corn varieties and their adaptation and improvement have already been noted (E. S. R., 45, p. 129).

Results of 15 years' experiments on a large number of soil types in various sections of the State show an average acre increase of 10.34 bu. where 8 tons of manure were applied in a 4-year rotation and plowed under before planting corn, with no more manure applied until the beginning of the next rotation. The average annual increase of crops following corn in this rotation were oats 4.59 bu., wheat 4.73 bu., and clover hay 808 lbs.

In 9 years' work at Maryville, single listing gave an increase of 12.6 bu. per acre over plowing and surface planting. The use of furrow openers in surface planting returned 7.4 bu. per acre more than ordinary surface planting. Double disking ahead of the listing did not pay for the labor involved. Double listing produced 6.6 bu. less per acre than single listing. At Warrensburg the use of furrow openers increased the yield 3.9 bu. per acre over that of ordinary surface planting. At Columbia checked corn, two stalks per hill, averaged 43.7 bu., as compared with 41.4 from a three-stalk rate.

In tillage experiments at four substations, corn given shallow cultivation, late cultivation, and deep cultivation averaged 30.1, 27.7, and 23.6 bu. per acre, as compared with 39.8 bu. from plats surface scraped with a hoe. Where the land was ridged, in contrast with the shallow, late, and deep cultural operations, an average acre yield of 18.6 bu., 4 bu. less than on the shallow cultivated plats, was secured.

Based on yields at Columbia, Cuba, and Warrensburg, sweet sorghums are considered superior as a forage crop to either corn or kafir, the best of the grain sorghums. Results so far secured recommend grain sorghum for a grain crop and sweet sorghum for forage for thin uplands of south Missouri. Corn production should be limited largely to the first and second creek and river bottom-lands and to the more productive uplands.

Experiments with combinations of corn with cowpeas and with soy beans have been noted heretofore (E. S. R., 33, p. 226; 43, p. 736).

Testing seed corn, G. N. HOFFER and A. T. WIANCKO (*Purdue Agr. Ext. Bul. 97 (1921), pp. 12, figs. 10*).—The procedure of tests for vitality and disease infection in seed corn is outlined.

Spacing cotton on North Carolina soils, W. F. PATE and R. Y. WINTERS (*N. C. Agr. Col. Ext. Circ. 112 (1921), pp. 7*).—The maximum yields of seed cotton were secured from 3.5-ft. rows with 16 in. between hills in spacing tests conducted at the Iredell, Edgecombe, and Red Springs farms, while 12-in. spacing in 3.5 ft. rows gave the best results at the experiment station farm at Raleigh.

Cross-fertilization and sterility in cotton, G. L. KOTTUR (*Agr. Jour. India, 16 (1921), Nos. 1, pp. 52–59; 4, pp. 406–409*).—A discussion of cross-fertilization and sterility in Kumpta and Dharwar-American cotton.

Results of field studies indicate that three forms of sterility exist in Kumpta and other cottons growing at Dharwar, (1) affecting all the floral parts except the calyx, (2) affecting the anthers, and (3) interfering with the development of the ovules in the ovary. The amount of sterility has not been found to increase in pure strains subject to continued self-fertilization for a number of generations.

Sterility did not increase and enhanced yields were secured in the F_1 generation of a cross between strains of *Gossypium herbaceum* and *G. neglectum*. The F_2 and F_3 generations showed increased sterility and gave decreased yields.

[Report of the work of] the British Cotton Growing Association (*Brit. Cotton Growing Assoc. [Pub.] 66 (1918), pp. 32, pl. 1; 68 (1919), pp. 32, pl. 1; 71 (1920), pp. 40, pl. 1; 72 (1921), pp. 36, pl. 1*).—The status of cotton production in British possessions is briefly reported for the years ended December 31, 1917, 1918, 1919, and 1920, respectively.

Development of tubers in the potato, C. F. CLARK (*U. S. Dept. Agr. Bul. 958 (1921), pp. 27, figs. 10*).—The conditions attending the setting and subsequent development of the tubers of the potato were studied at the Colorado Potato Experiment Station at Greeley, and minor observations were made in Maine.

The beginning of tuber formation coincided very nearly with the end of the period of flower-bud development. Records of weights and number of tubers from hills of Rural New Yorker, dug at one week intervals, commencing soon after tuber formation had started and continued until the vines were completely frost killed, showed that practically the entire crop of tubers was set at the beginning of the period of tuber development, probably within the space of a very few days. The maximum rate of growth of tubers took place about the last of August or first of September, approximately 80 days after planting, when nearly one-third of the total period of tuber development was completed. Inequalities in size of tubers in the individual hill are held to be largely due to unequal rates of growth rather than to differences in the age of the tubers. A small increase in the weight of tubers occurred after the vines were frost killed.

Measurements of stolons and weights of tubers produced thereon in 55 hills of Charles Downing potatoes did not give conclusive evidence that the weight of the tuber is dependent upon the length of the stolon bearing it. A high degree of relationship between the position of the stolon and its length was indicated in the variety studied, the shortest stolons being produced at the base of the stem with a gradual increase in length at the upper positions. The greatest average weight per tuber was produced by the lowest stolons in the 2-stolon and 3-stolon groups, while in the 4-stolon group maximum production took

place in the second position, with a gradual decrease in the weight in the upper stolons.

Considerable variation was noted in the tuber producing capacity of different varieties grown under similar conditions. Experiments on different types of soil indicated a close relationship existing between the character of soil and the number and weight of tubers, the largest numbers and weights being produced on the lighter types of soil. Irrigation and size of seed tests have been already noted (E. S. R., 45, p. 39).

The influence of size and character of seed on the yield of potatoes, R. N. SALAMAN (*Jour. Min. Agr. [London], 28 (1921), No. 1, pp. 43–48*).—Although small tubers gave large returns in proportion to their weight and produced as much marketable stock as any class of seed, they were decidedly unprofitable. Tubers of 2 oz. weight were best. Over this weight, seed tubers gave smaller yields, while the amount of seed used was progressively greater and the marketable stock was progressively less. The tendency to secondary growth formation was not conveyed to the crop from the seed tuber. It is considered that seed tubers with secondary growth make exceedingly good seed.

Rice investigations, L. G. WILLIS and J. O. CARRERO (*Porto Rico Sta. Rpt. 1920, pp. 13, 14*).—In studies of the factors governing rice production it was found that potash was apparently not a limiting factor in the soils used, and under some conditions phosphates tended to cause a chlorotic condition of the plant due to faulty assimilation of iron. A difference also noted in the response of the plant to different forms of phosphate fertilizer was not explainable as being due to difference in availability. The different phosphates varied considerably in their tendency to produce chlorotic rice. Trials of different forms of nitrogen for rice appeared to indicate that the results varied according to the reaction of the soil. Ammonium salts, except ammonium phosphate, were decidedly preferable for neutral or basic soils, and the nitrates gave the best results on acid soils.

Rice in the Philippines, J. S. CAMUS (*Philippine Bur. Agr. Bul. 37 (1921), pp. 90, pls. 47*).—Prepared primarily as a practical guide to the rice growers of the Phillipine Islands, this bulletin, based on 11 years of experimentation by the Bureau of Agriculture, is deemed of interest to scientific agriculturists. The principal topics discussed and illustrated include varieties, soil and climatic adaptation, irrigation methods, cultural and field operations, cost of production, harvesting, milling, by-products, feeding, food values, and rice pests.

Experimental work with rice included variety and head-to-row tests. Of 1,282 sorts tested since 1909, only 991 were found to be distinct varieties. These varieties, with brief descriptions, classification, origin, maturity, and yields are listed in tabular form.

Rosen rye, F. A. SPRAGG (*Michigan Sta. Spec. Bul. 105 (1921), pp. 11, figs. 8*).—In this publication Rosen rye is described and its origin indicated. Rye pollination, varieties, and cultural practices are discussed, and the work of the Michigan Crop Improvement Association in the improvement and distribution of the variety is outlined by J. F. Cox. Originating from a sample received from Russia through J. A. Rosen in 1909, this variety or its grades now probably constitute about 85 per cent of the rye grown in Michigan.

Sugar beet growing in Michigan, J. F. Cox and E. B. HILL (*Michigan Sta. Spec. Bul. 106 (1921), pp. 23, figs. 20*).—Approved cultural methods and field practices employed in sugar beet production in Michigan are discussed under the topics of soils, land preparation, fertilizing, seed bed, planting, seed production, blocking, thinning, hoeing, cultivating, harvesting, feeding tops and leaves, and rotations. The sugar factories in the State are listed, and their locations and the leading production areas are indicated on an outline map.

Sugar cane for sirup making, E. B. FERRIS (*Mississippi Sta. Bul. 199 (1921), pp. 3–20*).—A revised and enlarged edition of Bulletin 129 (E. S. R., 23, p. 40).

Sunflowers as a farm crop, C. A. ZAVITZ (*Ontario Dept. Agr. Circ. 35 (1921), pp. 4*).—Variety, cultural and field tests, digestion trials, and analyses of sunflowers conducted at the Ontario Agricultural College are reported.

In tests running from 1902 to 1920, inclusive, Mammoth Russian made an average acre yield of 5.6 tons of heads, 1,453 lbs. of ripened seed, and 18.2 tons for the whole crop. In a test of three varieties, Black Giant led with 13 years' average acre yields of 6.6 tons of heads and 20.26 tons for the whole crop.

Sweet clover, C. R. MEGEE (*Michigan Sta. Circ. 46 (1921), pp. 4, figs. 2*).—Practical information on varieties, liming, inoculation, seeding, and harvesting of sweet clover for hay and seed.

Relation of hardness and other factors to protein content of wheat, H. F. ROBERTS (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 507–522, pl. 1, figs. 2*).—Investigations of the relation of hardness and other factors to the protein content of wheat were conducted at the Kansas Experiment Station, with the object of devising a method of selecting for protein content that would eliminate the necessity of preliminary chemical analyses where numbers of strains or races of wheat are being tested. Crushing points (E. S. R., 23, p. 238) and protein percentages were determined for 94 pure strains of wheat. Results of similar work at the California Experiment Station (E. S. R., 25, p. 765) and the Kentucky Experiment Station (E. S. R., 16, p. 971) are described, and the three methods used for testing wheat for hardness are described and illustrated.

In spite of the generally accepted belief that the harder wheats are usually the higher in protein, the correlation coefficient between the crushing or breaking point of the kernel in grams and the percentage of protein was only 0.02 ± 0.003 for the Kansas data, 0.01 ± 0.061 for the California data, and 0.03 ± 0.1545 for the Kentucky data. The correlation coefficient between specific gravity and protein was found to be 0.0587 ± 0.081, and that between the volume of the grain and protein was zero.

Report of the Dominion Grain Research Laboratory, F. J. BIRCHARD (*Canada Dept. Trade and Com., Grain Research Lab. Rpt. [1913–1918], pp. 74, figs. 17*).—Investigations reported for the period 1913–1918 included studies of moisture in grain in transit and storage, tests of the electrically heated Brown-Duvel apparatus, milling and baking experiments, and flax grading.

Less than 14.7 per cent moisture is considered the limit of safety in sound wheat for cars in transit from internal points to terminal elevators during summer weather. Observations on grain stored at Port Arthur (Ontario) from August 3 to October 1 indicated that sound wheat containing 16.5 per cent or less moisture may be safely stored at the terminal elevators. Wheat with a considerable amount of frosted and green kernels will heat if it contains from 15.5 to 16 per cent or more moisture. Low-grade grain with frosted, green, and shrunken kernels and containing 16.2 per cent moisture will heat very readily, and the heating will not be checked by the advent of cold weather.

Milling and baking tests of tough and dried grain indicated that when wheat with an abnormally high moisture content is stored under conditions which do not admit of heating, it undergoes some chemical change whereby its baking value is distinctly impaired. The drying as conducted at the Government elevators did not cause any serious deterioration, and tough wheat may be safely dried at a temperature of 149° F. without injury. The temperature at which deterioration occurs evidently depends upon the amount of moisture originally in the grain. Baking tests indicated that wheat with a low moisture content

could be dried without injury at considerably higher temperatures than that with a higher moisture percentage.

No marked differences were found in the milling and baking values of Marquis and Red Fife wheat.

The most noticeable effect produced by frosted wheat kernels is the tendency to reduce the volume of the loaf, and where the damage is very heavy, to give a gray or dark appearance to the bread. The effect of the presence of green grains in wheat is very similar to that of frosted kernels, but is much more severe. The volume of the loaf is considerably reduced and the general appearance is poor. The color in most cases is decidedly gray, and the texture is rendered hard and coarse. Large amounts of bleached grains appeared to improve the baking quality of the flour. The presence of spotted kernels did not affect the quality of the flour except in regard to color, which was slightly yellow.

Determinations of the oil content in different grades of flax revealed that in general the amount of oil obtained from the seeds is directly related to the size and plumpness of the seeds, and that this should be the chief factor to be considered in grading. The presence of dark brown, immature seeds even in fairly large amounts was without noticeable influence on either the quality or quantity of the oil produced, so that the grading down of flax samples containing large quantities of heavy and plump seeds because they show immaturity is not considered justifiable.

Utilization of sisal twine already employed in grain harvest (*Rev. Facult. Agron. y Vet. La Plata, 2. ser., 14 (1919), No. 1, pp. 1–28, pls. 13*).—A discussion of the practicability of recovering and utilizing sisal binder twine used in harvesting wheat and oats. The used twine is recovered at the bundle carrier, cleaned, and hand woven into ropes and coarse fabric. Data on the areas of wheat and oats grown in Argentina and the amount of sisal imported in the period 1908–1918, trials of various makes of binders to determine the number of shocks produced per hectare, and the value of twine per hectare for the number of shocks harvested are tabulated, and the practices involved in the recovery of the twine are illustrated.

Report on a survey of the principal seed-growing counties of England, Wales, and Scotland, S. P. Mercer (*Min. Agr. and Fisheries [London], Misc. Pub. 29 (1921), pp. IV+96, figs. 17*).—A survey of the seed-growing districts in England, Scotland, and Wales, made in 1919 to ascertain the extent of culture and districts suitable for the various species, climatic and soil conditions for seed production, and the possibility of extending seed growing, is reported. The agricultural conditions, varieties, and cultural and field practices followed are detailed for the principal seed-producing counties.

In general, the heavy lands, largely derived from bowlder clay drift, are used for red clover seed growing; white clover is produced on heavy and medium soils; and although both trefoil and sainfoin are found on clay land containing chalk, seed growing is most strongly developed in calcareous districts. Grass seeds in England are only produced in quantity in the fen districts, with smaller amounts in other places as a by-product of the clover harvest. The Scottish counties, Ayr, Stirling, and Perth, produce rye grass and timothy.

Grass and clover seed growing in Great Britain, S. P. Mercer (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 535–547, fig. 1*).—A summary of the above.

[Seed inspection in Virginia, 1919–20], G. T. French (*Va. Dept. Agr. and Immigr., Commr. Ann. Rpt., 1920, pp. 36–45*).—A total of 4,555 purity and germination tests of seed samples were made during the year ended September 30, 1920. Scarcity and high price of standard clovers are held responsible for

the use in clover and grass mixtures of an annual sweet clover (*Melilotus indica*). It is stated that this is entirely unsuited for Virginia conditions, and should not be confused with the annual sweet clover propagated by the Iowa Experiment Station (E. S. R., 44, p. 431).

HORTICULTURE.

[Report of horticultural activities], T. B. McClelland, J. P. Griffith, W. V. Tower, and H. C. Henricksen (*Porto Rico Sta. Rpt. 1920, pp. 16–23, 25, 27–36, pls. 2*).—For the most part a progress report of investigations already under way (E. S. R., 44, p. 441).

In a test of the effect of pruning and heavy shading on the yield of vanilla, both practices reduced the crop of a 3-year-old planting. "Where the supporting trees were kept closely pruned to allow as much sunlight as possible to reach the vines, the unpruned vines gave three times as great a crop as the pruned and densely shaded vines and more than twice as great a crop as where there was but a single variant factor, either heavy shading or pruning." The Fernandez mango, S. P. I. 19117, fruiting for the first time on the station grounds, is described in detail and is deemed a valuable acquisition provided a certain tendency to decay does not increase.

Varietal and acclimation tests of practically all the common garden vegetables are reported. Tomato No. 443 (a cross between Livingston Globe and a native cherry tomato), bred at the Insular Station at Rio Piedras, proved valuable on account of its vigor and yield, but lacked in uniformity. On account of the prevalence of wilt disease, resistant tomato strains from the U. S. Department of Agriculture and the Ohio Experiment Station are being tested.

The suitability of various plants and trees as windbreaks for citrus groves is discussed. Certain leguminous species are deemed valuable for temporary protection in that they do not draw heavily on the fertility of the soil. The bamboo is considered excellent only for severely exposed situations and is being replaced by the bucare, guava, and guama trees for permanent windbreaks. Trees mulched in February with cane trash showed a fuller bloom the following June than those unmulched. In a test of nitrogen *v.* nitrogen and potash as a fertilizer for grapefruit trees, practically no difference was noted in yield or size of fruit, but there was a marked increase in the percentage of fancy fruit in favor of the plat receiving potash. Less fruit seemed to be produced in the shade of guava trees, but it was much more attractive.

As a part of a general survey of the fruit industry of Porto Rico, data are given relative to the cost of handling, amount and value of exports, relation of grade to price, and losses from decay. Some preliminary investigations were conducted upon certain factors involved in fruit shipment, including a study of the temperatures of fruit and surrounding air at the wharves and aboard ship, the influence of storage temperature on keeping quality, and the effect of covering fruits with paraffin and shellac. The paraffin treatment showed interesting possibilities as a preventive against contamination and shriveling but did not prevent stem-end rot of oranges.

The hardiness problem, M. J. Dorsey and J. W. Bushnell (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 210–224*).—A comprehensive summation of the present status of the hardiness problem, citing the extensive losses due to winter injury and discussing the bearing of horticultural practices, the rest period, and genetical and physiological factors on the subject. A bibliography of 51 citations to the literature is included.

Record of short hardwood cuttings (*Missouri Bot. Gard. Bul. 9 (1921), No. 6, pp. 77–85*).—A tabulated summary of the results of a rooting test of hard-

wood cuttings taken directly from the plants in a dormant condition and placed in an ordinary sand cutting bed. Over 200 species and varieties of ornamental and fruit plants are included.

Inspection of insecticides and fungicides, 1920 (*New York State Sta. Bul. 481 (1920), pp. 3–18*).—Analyses are reported of insecticidal and fungicidal materials sold in the State of New York.

Preliminary note on the fruits in the Diyalah district, G. Gautby (*Mesopotamia Agr. Dir. Mem. 4 (1921), pp. 9, pls. 2*).—Brief descriptive notes are given for the fruits now cultivated, with suggestions relative to future improvement.

Report of horticultural department, C. A. McCue (*Delaware Sta. Bul. 126 (1920), pp. 18–22*).—A study of determinations obtained by analysis of the leaves of peach trees receiving various fertilizer treatments leads to the conclusion that greater variation in nitrogen content exists between trees of like fertility treatment and those of unlike treatment.

Annual and biennial bearing trees were observed within a single apple variety. The author, separating biennial bearing Staymans into two classes, even and odd year producers, concludes that there is a close correlation between available plant food and bearing habit. In alternate bearing trees, the year of production seemed to succeed a year of relatively great increase in trunk increment.

Brief comments are made upon other activities.

Studies in orchard management.—II, Factors influencing fruit development of the apple, K. Sax (*Maine Sta. Bul. 298 (1921), pp. 53–84, fig. 1*).—A biometrical study of certain factors involved in the pollination and development of the fruit of the apple. This paper, second in a general series (E. S. R., 43, p. 645), deals with (1) the relation of seed formation to set and development of the apple, (2) the relation between vigor of the tree and seed and fruit development, and (3) the influence of seed formation on the shape of the fruit.

In a study of the relation of seed content to weight in immature Ben Davis apples, in each case two from the same spur, one about to drop and the other to set, the author found fewer seeds in the drop apples. On the other hand, mature apples, borne in pairs in a similar manner, when separated into large and small grades were found to have an identical seed content. Apples from a poorly nourished, sod-grown Ben Davis tree contained more seeds than larger apples from a thrifty well-fed tree of the same variety.

Heavy thinning of the blooms of a Ben Davis tree, followed by hand pollination of the remainder with pollen from three compatible varieties, resulted in a seed content only slightly larger than that of the poorly nourished tree above noted. Observations on Baldwin, Northern Spy, and Golden Russet indicated that marked varietal differences exist in the seed content and weight relation.

The influence of pollen of different varieties on the number of fruits and the seed content is shown in tabular form for several crosses, and indicates in general that some correlation exists between compatability of varieties and number of seed. In a study of the relation between the number of seedless carpels and the weight of fruit of the Baldwin and Ben Davis, the author found a negative correlation. Food is deemed an important but not a controlling factor in fruit setting, in that severe thinning followed by covering of the remaining blooms of a well-nourished Ben Davis tree, normally self-sterile, failed to induce the formation of seedless apples. Apples developing after the removal of two stigmas and hand pollination of the remaining three were found to be generally misshapen and of very little commercial value. By cutting these

fruits into five segments corresponding to the carpels, the author was able to determine the effect of the presence or absence of seeds upon the development of the respective segments. In general, the uniform development of the fruit was observed to be dependent on the seed content. However, in the case of seedlessness in only one carpel sufficient stimulation was apparently received from the neighboring seeds to insure good shape.

It is concluded in part that, for the fruits studied and under the conditions obtaining during the experiments, the presence of seeds is positively necessary for setting of fruits and that food, although unable in itself to insure setting, is a very important factor in satisfactory development.

Studies in apple pollination, O. M. MORRIS (*Washington Sta. Bul. 163 (1921), pp. 32, figs. 6*).—In this report of studies relative to pollination and seed and fruit development in the apple, self-fruitfulness tests with commercial varieties, part in the station orchard and part in the Spokane Valley, indicated that none of the varieties under study are fully self-fertile, Oldenburg leading with a set of only 11.46 per cent. The usual occurrence of cross-pollination was shown by the fact that the seed content of Rome Beauty and Jonathan apples produced under tents, with and without the presence of bees, was markedly less than that of apples from normally exposed trees.

A tabulation of the blooming periods of 80 varieties at the station is included. Compatability between varieties, as indicated by the set of fruit in controlled crosses, is shown in tabular form, the author pointing out the disparity in results occurring in repeated crosses.

In studies quite similar in nature to those of Sax, above noted, bearing on the relation of seed content to set, size, and shape of apples, the author found that June-drop apples contained markedly fewer seeds than set apples, that in general large fruits contained more seeds than small fruits, and that the carpels in the smaller section of extremely one-sided apples were usually devoid of seeds.

A preliminary report on apple and pear breeding in Maryland, E. C. AUCHTER (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 19–32*).—A partial review of fruit-breeding investigations, inaugurated at the Maryland Experiment Station in 1905, a preliminary report upon which has been noted (E. S. R., 36, p. 444).

A total of 1,368 pear and 1,073 apple seedlings have been grown. Tabulated data are given relative to the size, color, flavor, and date of ripening of the seedlings from a part of the 1907 apple crosses. Following a discussion of the data, the author concludes in part "that in the varieties studied, neither the male nor female parent is the more prepotent in transmitting such factors as form, color, and flavor. . . . The factor or factors transmitting red color seemed to be dominant over those transmitting yellow color regardless of which variety was the maternal or the paternal parent. The factor or factors transmitting acid to subacid flavor appeared dominant to those transmitting mild subacid or nearly sweet flavor. Date of ripening is evidently an inherited character, as all seedlings had about the same ripening period as their parents. Of the 166 crossed seedlings, 24 appear to be very promising and in addition 8 are held for further testing. Williams especially is a good variety to use in early apple breeding."

Biennial fruit bearing in the apple, J. W. CROW (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 52–54*).—The author maintains that biennial bearing is not a fixed character in the Wealthy and Oldenburg apple varieties but is due to the development in some one year of blooms on too many of the spurs. Annual bearing was induced by two different methods, moderate pruning of small branches in the off year and applications of nitrate of soda very early

in the off year. A tabulation of the results of an experiment in bud and blossom removal shows 79 per cent of fruit bud formation from spurs disbudded before the first blossoms had well set and none from spurs disbudded after that stage.

The light factor in apple storage, G. Rivière and G. Pichard (*Jour. Soc. Natl. Hort. France, 4. ser., 22 (1921), May, pp. 180, 181*).—In a storage study with Calville Blanc apples, fruits stored in darkness were found to keep longer and to retain a higher total sugar content than those stored in light.

The rise of commercial apple orchards in Vermont, M. B. Cummings (*Vermonter, 26 [1921], No. 1, pp. 2–14, figs. 9*).—A popular depiction of the recent rapid growth and improvement in commercial apple production in Vermont. Statistical data, presented in tabular form, relative to plantings since 1912, include one single enterprise of 5,500 acres.

Why the plum fails to set fruit, M. J. Dorsey (*Minn. Hort., 48 (1920), No. 12, pp. 356–362, figs. 3*).—A practical interpretation of several phases of the author's studies in the sterility of the plum, previously noted (E. S. R., 42, p. 534).

Small fruit growing in Missouri, H. G. Swartwout (*Missouri Sta. Bul 184 (1921), pp. 3–27, figs. 5*).—For the greater part a compilation of useful information pertaining to the general cultural requirements of bush fruits and strawberries. Considerable yield data for the years 1919–1920 are given in tabular form, including the comparative production of red, black, and purple raspberry varieties on two soil types, one at Columbia and one at Turner; the yield of 10 blackberry varieties at Turner; and plant and fruit production of 8 ever-bearing strawberry varieties at Columbia, both with and without irrigation.

Irrigation favored the production of plants and of fruit, but, as summed up by the author, "the increased yields secured from irrigation on the trial grounds at Columbia were not sufficient to make the ever-bearing strawberry of commercial value from the standpoint of the fall crops. Not only was the total fall yield low, but the individual pickings were so small that few, if any, would pay for the cost of picking and handling."

Some responses of bush fruits to fertilizers, W. H. Chandler (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 201–204*).—A brief account of a nutritional study with bush fruits at the New York Cornell Experiment Station during the years 1918–1920. Yield and growth of currants, gooseberries, and red raspberries from plats receiving various manurial treatments are shown in tabular form, and lead the author to point out that "currants have shown no measurable response to any element. . . . Gooseberries have responded to nitrogen and possibly to potassium, but the response to manure has been much greater than that to complete mineral fertilization. . . . In case of the Cuthbert raspberry, however, sodium nitrate seemed actually to cause a larger response than was caused by the same amount of nitrogen in manure, tankage, or dried blood."

Blackberries of New England.—Genetic status of the plants, A. K. Peitersen (*Vermont Sta. Bul. 218 (1921), pp. 3–34, pls. 19*).—A second report upon a series of experiments begun in 1914, in an effort to remove the uncertainty existing in regard to the origin of the confusing number of species and forms of wild New England blackberries (E. S. R., 44, p. 237). The present paper deals with two phases of the study, (1) the effect of light, temperature, and humidity upon the development of external characters, hairs, prickles, etc., and of light upon the habit of growth and (2) a genetic analysis of the various species and forms under observation.

The development of outgrowths on the stem, such as prickles and hairs, was found to be little, if any, influenced by humidity or temperature; on the contrary to be markedly affected by light, increasing in number in direct proportion to the intensity. Plants grown in shade or partial absence of light were found to grow more erect than those in full light.

Working on the hypothesis that hybridity of origin is manifested by absolute or partial sterility, the author made a careful genetic study of the material at hand. Four methods of technique, (1) determination of per cent of aborted pollen, (2) covering of blossoms, (3) germination of pollen, and (4) hybridization experiments, were utilized. The results are presented in tabular form.

"A large percentage of infertility occurs in most species of blackberries. . . . Sterility among the blackberries is largely due to defective pollen. The percentage of infertility in a given species is quite constant. . . . Cross-pollination is the rule in all species of blackberries. All species of Rubus studied are either nearly or completely self-sterile. All New England blackberries are capable of intercrossing under favorable conditions for doing so. Duplicates of natural hybrids have been produced by artificial hybridization. The progeny of a number of so-called species of blackberries segregate, a character which is present only in organisms of hybrid origin. In view of the data presented, it is concluded that spontaneous hybridization is quite common in the Eubatus group, and that a large number of the so-called species are either hybrids or cryptohybrids brought about probably by the interbreeding of two or more elementary species."

The relation of water-raking to the keeping quality of cranberries, N. E. Stevens and H. F. Bergman (*U. S. Dept. Agr. Bul. 960 (1921), pp. 12*).—A contribution from the Bureau of Plant Industry, discussing certain features of a method of harvesting cranberries in use in Wisconsin, in which the bog is flooded and the floating berries gathered with rakes. The investigations, covering a three-year period, 1918–1920, include a study of the water-raking practice, of the relation of stage of development of berry to keeping quality, of the effect of proper drying and ventilation, and of temperature and oxygen content of flood water, together with a comparison of water-raking with the usual methods of harvest and of the behavior of the water-raked fruit in storage.

The authors summarize in part as follows: "Ventilation is of great importance in the storage of water-raked cranberries, as of cranberries harvested in other ways. Green berries are more easily injured in water-raking than ripe (fully colored) berries. Cool water and water having a high oxygen content are much less likely to cause injury in water-raking than warm water or that having a low oxygen content. Under the most favorable conditions the writers have been able to obtain, the keeping quality of water-raked cranberries was somewhat inferior to that of dry-raked berries from the same sections and about equal to hand-picked berries." Practical suggestions based on the experimental evidence are included.

Studies on the cost of producing grapes, F. E. Gladwin (*New York State Sta. Bul. 479 (1920), pp. 3–33*).—A study in the cost of producing grapes in the Chautauqua and Lake Erie fruit belt during the period 1915–1919, based on data obtained in three widely separated vineyards having a total area of 34 acres. Tabulated "data are presented which show the amounts expended for maintenance, labor, and harvesting for each vineyard as well as for each acre cultivated and for each ton of grapes produced. The net return per acre and per ton is estimated for each year of the investigation.

"The average cost of production for the three vineyards during the five years was $74.13 per acre, and the average cost per ton of grapes was $40.58.

The average net profit per acre was found to be $66.64, and the average profit per ton $26.31." The average profit per acre for the individual vineyards for the five-year period ranged from $39.30 to $86.76. It is noteworthy that larger net profits are associated with higher costs of production, the increased tonnage of grapes being sufficient to overcome the differences in costs per acre.

"It is concluded that under intensive management the growing of grapes in this region can be made profitable, in spite of the high cost of labor and supplies, providing the selling price of the crop is maintained at or near the level of the 1918 and 1919 seasons."

The cost of producing grapes in the Chautauqua and Lake Erie fruit belt, J. D. LUCKETT (*New York State Sta. Bul. 479, pop. ed. (1920), pp. 3–7*).—A popular edition of above.

The story of the banana, P. K. REYNOLDS (*Boston: United Fruit Co., 1921, pp. 53, pl. 1, figs. 31*).—An illustrated pamphlet, depicting the various phases of banana production from the establishment of the plantation to the final marketing.

Cocoa and chocolate, their history from plantation to consumer, A. W. KNAPP (*London: Chapman & Hall, Ltd., 1920, pp. XII+210, figs. 100*).—A general survey, introduced by brief historical notes, of the cocoa and chocolate industry.

Date varieties of the Derna Oasis, E. BROGLIO (*Agr. Colon. [Italy], 15 (1921), No. 8, pp. 401–406, pls. 2, figs. 14*).—Descriptive notes are given for the fruits of 14 named varieties of dates.

The mango, P. J. WESTER (*Philippine Bur. Agr. Bul. 18 (1920), 2. rev. ed., pp. 70, pls. 18, figs. 8*).—From this revised edition (E. S. R., 26, p. 841) there has been eliminated data relative to botany, geography, history, and bibliography found in the first issue. A brief discussion of other Mangifera species bearing edible fruits is included.

Trial of nitrogenous manures on tea, H. R. COOPER (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1921, No. 1, pp. 11–20, pls. 3*).—In a fertilizer test with tea at the Tocklai Experiment Station, nitrate of soda was found superior to four other forms of nitrogen in increasing the yield of green leaves.

Nut culture in China, J. H. REISNER (*Amer. Nut. Jour., 14 (1921), No. 2, p. 17*).—A brief account of the more important nut species, noting their characteristics and distribution.

The Zorn hickory nut, largest on record, W. G. BIXBY (*Amer. Nut. Jour., 14 (1921), No. 2, p. 16*).—Of probable hybrid origin, this nut is commended on account of its size and good quality.

The Stabler black walnut—a peculiar characteristic, W. G. BIXBY (*Amer. Nut. Jour., 14 (1921), No. 3, pp. 34, 35, figs. 2*).—An illustrated account of a peculiar tree, part of the nuts of which are perfect and part containing only one lobe.

Medicinal plants, C. D. GIROLA (*Bol. Min. Agr. [Argentina], 25 (1920), No. 2, pp. 175–209*).—This is the second part (E. S. R., 43, p. 746) of an investigation of cultivated medicinal plants, in which the author briefly considers the species grown in various parts of the world exterior to Argentina. A list of the medicinal plants growing in the Buenos Aires Botanic Garden is appended.

A genetic study of two Godetia species, H. RASMUSON (*Hereditas, 2 (1921), No. 2, pp. 143–289, pl. 1, figs. 29*).—An elaborate study of two Godetia species, *G. whitneyi* and *G. amoena*, based on crossing the species and varieties within each species.

Varietal crosses within *G. whitneyi* indicated, in part, that single flowers are more or less completely dominant over double and that a low, dense type of growth is recessive to a high open type. A sectorial chimera was obtained in the F_2 generation of a cross between *G. amoena* varieties. Crosses between *G.*

amoena and *G. whitneyi* were almost all completely sterile, both as to pollen and ovules. Observations as to flower color, doubleness of flowers, and height of plant indicated that the genes in the species crosses behaved in exactly the same manner as in the varietal crosses.

Floriculture in the United States, H. B. DORNER (*Amer. Florist, 57 (1921), No. 1733, pp. 269, 270*).—This paper, delivered before the Society of American Florists, Washington, D. C., in August, 1921, directs attention to the relatively slow progress of educational and investigational as compared with commercial floriculture. Data are given on the amount of glass, area of land, and educational facilities devoted to floriculture at some of the larger agricultural institutions.

The production of the Easter lily in northern climates, D. GRIFFITHS (*U. S. Dept. Agr. Bul. 962 (1921), pp. 31, figs. 14*).—A contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, a brief popular article on the subject having been previously noted (E. S. R., 45, p. 347.)

The present paper deals for the greater part with the various operations included in the propagation of Easter lilies by seed, from hand pollination of the parent blooms to the care of the mature plants. Vegetative propagation by bulblets, scales, and cuttings and various production factors such as soil, fertility, storage, and temperature requirements are discussed. "It has been amply demonstrated that the lily is sufficiently hardy in the latitude of Washington, D. C., to live through the winter either with or without a little mulch. The probability is that it will be found to be hardy very much farther north."

FORESTRY.

A short manual of forest management, H. JACKSON (*Cambridge: Univ. Press, 1921, pp. X+70, figs. 4*).—The subject is discussed in a concise, practical manner.

Working plan for a communal forest for the town of Ithaca, N. Y., J. S. EVERITT (*New York Cornell Sta. Bul. 404 (1921), pp. 51–99, figs. 14*).—Following a resumé of the principles underlying the establishment and successful management of communal forests, the author directs attention to the proposed Ithaca forest. The tract under consideration is located about 1.5 miles from the city and includes 1,425 acres, now privately owned and consisting of different types of land, varying from arable to steep rough hillside. A portion of the area is covered with second-growth hardwoods. Preliminary field work, completed by the department of forestry, has enabled the author to classify the land into five types, to enumerate the existing forest species, and to outline a plan of silvicultural management, involving thinning, planting, and general care, including fire protection and fungus and insect control. An estimate is presented of the probable revenues and expenditures for the initial 10-year period. The future of the project is summed up by the author. "Taking into account the cost of the land and of planting, taxes on land and timber, and a small charge for protection, and assuming that the stumpage will be worth $500 an acre in 45 years, a rate of interest will be earned which will be equivalent to about 6.5 per cent compound."

Trees of Indiana, C. C. DEAM (*Ind. Dept. Conserv., Pub. 13 (1921), pp. 317, figs. 137*).—This third edition of a work previously noted (E. S. R., 41, p. 46) has been revised and improved by the addition of photographic illustrations of the author's herbarium specimens.

Windbreaks for Minnesota prairie farms, W. H. KENETY (*Minn. Farmers' Inst. Ann., No. 33 (1920), pp. 149–160, figs. 8*).—In addition to lists of trees

hardy and suitable for various counties of Minnesota, general information is given relative to the establishment and maintenance and value of windbreaks.

Growth in trees, D. T. MacDougal (*Carnegie Inst. Wash. Pub. 307 (1921), pp. 41, figs. 16*).—The increments in diameter of 15 widely distributed tree species were recorded during the season of 1920 with the aid of the dendrograph, a descriptive account of which has been previously noted (E. S. R., 40, p. 817). Data illustrated by copies of original graphs, given for a few of the species, indicate that the period in which enlargement occurs is comparatively brief. In the instance of three species no increment was observed. Irrigation of a California live oak resulted in an appreciable gain within two hours, although rainfall was usually followed by a lapse of several hours before enlargement was recorded. The dendrometer, a less intricate instrument designed to record total increase over a considerable period, is described.

The influence of water sprouts upon the yield and shape of the oak, E. Mer (*Bul. Soc. Agr. France, 1921, July, Sup., pp. 171–178*).—A report of a pruning investigation with the oak in which the removal of succulent sprouts from the trunk was found to increase the annual increment in volume and to favor a better development of the tree.

A new yield table for pine, Gehrhardt (*Allg. Forst u. Jagd Ztg. [Frankfurt], 97 (1921), July, pp. 145–156, figs. 5*).—The author presents a new yield table for the pine based on data secured from several existing tables.

Observations and experiments on the culture and exploitation of Hevea brasiliensis, G. Vernet (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 3 (1921), Nos. 4, pp. 97–103; 5, pp. 146–149; 6, pp. 182–186; 7, pp. 211–214; 8, pp. 242–251*).—In this contribution relative to miscellaneous experiments with *H. brasiliensis,* an outline is given of a simple test of the viability of seed made by cross sectioning the kernel with a very sharp blade and observing whether or not there is an exudation of latex on the cut surface, the appearance of latex indicating life. The author was able to germinate seed in 12 days after piercing the envelope and immersing in water for 20 hours.

Tillage *v.* no tillage resulted in an increased yield in favor of the former, especially during the brief dry season. A discussion is given of several variations in the technique of tapping and their effect on the tree, yield, and quality of latex.

The National Forest resources of Alaska are for use, J. D. Guthrie (*Amer. Forestry, 27 (1921), No. 325, p. 12–14, figs. 6*).—A brief popular account of the extent and importance of Alaskan forests and forest industries.

Forest planting in Michigan, A. K. Chittenden (*Michigan Sta. Spec. Bul. 103 (1921), pp. 16, figs. 5*).—Practical directions are given for establishing forest plantations in Michigan, including information relative to soils, methods of planting, and desirability and special requirements of the more valuable species. A rate of growth table, based on measurements obtained in southern Michigan, is included. Windbreaks are briefly discussed in connection with a table showing the growth of trees planted for this purpose.

A list is given of the number and kind of trees originally contained in an experimental plantation established in a dry and sandy soil at Grayling, in 1888. Very few of the original 40 odd species proved at all satisfactory. "Of all the hardwood species which have survived none have shown any possibilities. They have largely failed even to develop to tree form and are mostly merely a scrubby growth, being either unable to withstand the severity of the climate or the infertility of the soil. . . . Of the 9 species of conifers planted, specimens of all still exist, but only a few have apparently demonstrated their ability to succeed under these conditions, the red pine, white pine, and Norway spruce. Two others show possibilities, the Scotch and pitch pines."

A table is included giving the diameter and height of both the maximum and average trees for the 9 coniferous species 32 years after planting.

Forestry in British Guiana (*Jour. Bd. Agr. Brit. Guiana, 14 (1921), No. 3, pp. 147–155*).—A summary of the statement prepared for the British Empire Forestry Conference by the forestry officer of British Guiana relative to area, utilization, activities, etc.

[Report of the] division of forestry, R. G. CORDOVA (*War Dept. [U. S.], Ann. Rpt. Governor P. R., [20] (1920), pp. 543–546*).—A brief summary of activities of the newly organized Porto Rico forestry division for the 12 months ended July 1, 1920.

Annual report on the forest administration in Ajmer-Merwara for the year 1919–20, SHAMBHOO DUTT (*Ajmer-Merwara Forest Admin. Ann. Rpt., 1919–20, pp. 29*).—This is the report for the year 1919–20 (E. S. R., 43, p. 241). Data relative to alterations in forest area, forest protection, revenues and expenditures, etc., are appended in tabular form.

Annual progress report on forest administration in the Presidency of Bengal for the year 1919–20, H. A. FARRINGTON (*Bengal Forest Admin. Rpt., 1919–20, pp. II+47+3*).—A progress report (E. S. R., 43, p. 651) relative to the administration and management of the State forests in Bengal, including appended data relative to forest areas, surveys, progress in working plans, forest fires, silvicultural operations, yield in major and minor forest products, revenues, expenditures, etc.

Report on forest administration in Burma for the year ended June 30, 1919, H. CARTER, J. W. A. GRIEVE, ET AL. (*Burma Forest Admin. Rpt., 1919, pp. III+[13]+302*).—A report on the administration and management of the State forests for the year ended June 30, 1919, to which are appended the usual statistical data relative to alteration in area, revenues, expenditures, fire protection, etc. (E. S. R., 42, p. 539). A review for the five-year period ended the same date is included.

Progress report of forest administration in Coorg for the year 1919–20, E. M. CROTHERS (*Coorg Forest Admin. Rpt., 1919–20, pp. [32]*).—A report similar to that of the previous year (E. S. R., 44, p. 240), containing the customary data on alterations in area, revenues, and expenditures, etc.

Progress report on forest administration in the Northwest Frontier Province for the year 1919–20, R. PARNELL (*Northwest Frontier Prov. Forest Admin. Rpt., 1919–20, pp. [11]+15+XXVIII*).—This report on forest activities during the year 1919–20 continues previous work (E. S. R., 43, p. 150).

Progress report on forest administration in the Punjab for the year 1919–20, A. D. BLASCHECK (*Punjab Forest Admin. Rpt., 1919–20, pp. [24]+LXXIII, pl. 1*).—The usual report (E. S. R., 44, p. 240).

DISEASES OF PLANTS.

Plant pathological [investigations], T. F. MANNS (*Delaware Sta. Bul. 126 (1920), pp. 24–26*).—Notes are given on studies of various diseases that have been investigated during the period covered by this report.

The results of investigations of the pox disease of sweet potatoes are held to indicate that this is a typical soil disease and very difficult of control. Heavy applications have been made of manure, lime, and phosphorus, alone and in various combinations, but with little or no benefit so far as the decrease of the disease is concerned.

Attention is called to the defoliation of peach trees, which was due to unusually cold, rainy conditions in the early season, and in other instances to injury arising from the application of arsenical sprays. Analyses of some of

the sprays were made, and one sample is said to have shown 3.29 per cent of water-soluble arsenic.

Continued observations are being made on the resistance of cantaloups to disease, and of 38 varieties tested 4 have given indications of partial resistance.

Diseases of economic plants in southern China, O. A. REINKING (*Philippine Agr., 8 (1919), No. 4, pp. 109–134, pls. 3*).—This is an account of the results of a plant disease survey of the agricultural regions of the delta of Kwang Tung Province around Canton, Macao, and Hongkong, and also in southern Kwang Si Province, along the West River. The primary object of the survey was to investigate the diseases of citrus.

It is said that in general the diseases in southern China are much like those in the Philippines. Attention was given primarily to the fungi occurring on economic plants. Brief descriptions of the diseases are given, together with the names of the causal organisms and suggestions regarding control measures. The host plants are arranged alphabetically according to their common names.

Diseases of plants, E. J. BUTLER (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 59–65*).—This portion of the mycologist's report deals with black band disease of jute, fruit disease work in Kumaun, cereal diseases, Pythium disease of ginger and other crops, potato storage rots, and root rot of cotton.

Relation of catalase, oxidase, and hydrogen-ion concentration to the formation of overgrowths, R. B. HARVEY (*Amer. Jour. Bot., 7 (1920), No. 5, pp. 211–221, figs. 2*).—It was found that the concentration of osmotically active substances was the same in tumor tissues as in healthy tissues of Ricinus. Osmotic relations do not, therefore, account for the tumor production in these cases associated with *Bacterium tumefaciens*. Catalase, oxidase, and peroxidase activity are greater and hydrogen-ion concentration is less in tumor tissue than in adjacent healthy tissues when the tumors are produced either by freezing or by inoculation with *B. tumefaciens*. Growth in frozen spots of Bryophyllum leaves was correlated with the accumulation within them from surrounding tissues of substances resembling catechol, which are transformed by oxidation into colored compounds.

Effect of crowngall inoculations on Bryophyllum, E. F. SMITH (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 593–598, pls. 10*).—In a previous publication (E. S. R., 43, p. 242) Levine reported that the crowngall organism inoculated into Bryophyllum "has no stimulating effect on the formation of shoots, but rather an inhibiting effect." The author of the present paper, which is a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, gives an account of inoculation experiments performed by him with the organism *Bacterium tumefaciens* on *B. calycinum*. He found, contrary to the claim of Levine, that a distinct crowngall stimulus exists for the dormant buds of *B. calycinum*.

Mosaic disease as a factor influencing yield (*Potato Mag., 2 (1919), No. 5, pp. 11, 27*).—Results of tests conducted cooperatively during 1919 in Suffolk County, Long Island, regarding the influence of local environment on potato mosaic and the influence of mosaic in reducing yields are presented in tabular form, with discussion of the work so far as completed.

Diseases of Rubachia glomerata, R. AVERNA-SACCÁ (*Bol. Agr. [Sao Paulo], 21. ser., No. 1–3 (1920), pp. 37–42, figs. 2*).—Fruits and leaves of *R. glomerata* are attacked by *Puccinia jambulana* (*Uredo flavidula*), which is said also to attack *Jambosa vulgaris* (leaves and fruits) and pine trees. *R. glomerata* is also subject to attack (as to the fruits) by *Gloeosporium fructus psidii*. Both these fungus diseases are controllable by Bordeaux mixture containing from 0.05 to 0.1 per cent of casein.

Diseases of Psidium araca, R. AVERNA-SACCÁ (*Bol. Agr.* [*Sao Paulo*], *21. ser., No. 1–3 (1920), pp. 43–45, fig. 1*).—*P. araca* was found to be attacked by a rust fungus, which is said to be widely distributed in the State of Sao Paulo, attacking also *P. goiaba*. A description is given of the fungus, which it is thought should be included in the genus Uromyces and not in Puccinia. The rust is almost always associated with the anthracnose fungus, *Glocosporium fructus psidii*.

Storage rots caused by Diplodia, G. M. REYES (*Philippine Agr., 8 (1920), No. 7, pp. 235–260*).—Rots caused by Diplodia are prevalent on agricultural products in field and storage, affecting fruits, roots, and woody hosts. Much damage was observed on such important products as sweet potatoes, cassava, gabi, yautia, yams, cacao, patani, and maize, about 50 diseases caused by Diplodia and its allies being found in the Philippines and around the College of Agriculture. Recommendations based on observations and experimentation are offered.

Compatibility of spray mixtures (*New Zeal. Jour. Agr., 19 (1919), No. 4, pp. 244, 245*).—This is a summary of a paper presented by W. C. Morris to the New Zealand Institute Science Congress in 1919. Examples are given of the diffierent neutralized or combined effects of compounds used as fungicides or insecticides or both.

The fungicidal action of formaldehyde, I. E. MELHUS, J. C. GILMAN, and J. B. KENDRICK (*Iowa Sta. Research Bul. 59 (1920), pp. 355–397, figs. 6*).—The results are given of laboratory and field experiments to test the efficiency of different methods of treatment in the control of the potato scab (*Actinomyces scabies*) and also of *Rhizoctonia solani*. Solutions at various temperatures and concentrations were investigated, comparisons being made with corrosive sublimate solutions.

For the control of scab, surface disinfection with formaldehyde was more complete at 20° C. (68° F.) than at lower temperatures. Formaldehyde treatment at 48 to 50° for short periods of time was as toxic as mercuric chlorid and formaldehyde of the standard formulas. Covering the potatoes after treatment with hot formaldehyde was found to facilitate disinfection. Increasing the concentration increased the toxicity toward both scab and scurf. Surface disinfection is seldom complete, and this fact is believed to introduce a variable factor into field treatment experiments.

For the control of scurf, tests were made which showed the thermal death point of Rhizoctonia sclerotia to be about 60°. All methods of seed treatment reduced the percentage of infection by Rhizoctonia, although the disinfection was not complete. The results of field trial are believed to indicate that seed treatment is worth while from a practical standpoint. It was found that the germination of the tubers was injured with corrosive sublimate 1:150 or formaldehyde 1:120 when the temperature was raised above 55° for more than 5 minutes. No injury followed the use of formaldehyde 1:120 at 50° for 2.5 minutes, followed by covering the tubers for one hour.

The effect of standing, heating, and treating of potatoes on dilute formaldehyde solutions was studied, and the data obtained indicated that formaldehyde solutions used changed strength only slightly on being exposed to room temperature in an open container for 26 days. Dilute solutions of formaldehyde heated to 50° and held at this temperature from 5 to 60 minutes showed no appreciable change in concentration. When potatoes were treated with formaldehyde solutions at 48° to 50° there was some loss in concentration of the formaldehyde, and this was greater when steam was used as a source of heat than when the temperature of the solution was raised by the form of heater described by the authors in a previous publication (E. S. R., 41, p. 38).

Diseases of vegetables in 1919, G. P. CLINTON (*Conn. Veg. Growers' Assoc. Rpt., 1919, pp. 54–60*).—A very condensed account is given of diseases affecting asparagus, beans, cabbage, cauliflower, celery, corn, cucurbits, onions, peas, potatoes, and spinach.

Cotton diseases in Sao Paulo (*Bol. Agr. [Sao Paulo], 21. ser., No. 4–5 (1920), pp. 227–291, figs. 23*).—This report contains an account of diseases and causes thereof, including *peronospora gossypina, Stilbum nanum gossypina, Nectria* sp., *Gibberella gossypina, Glocosporium gossypii, Collctotrichum gossypinum, Verticillium* sp., *Fusarium* sp., *Cercospora gossypina, Ramularia areola, Cladosporium* sp., *Phyllosticta gossypina, Sphaerella gossypina, Sphaeroderma gossypii, Colletotrichum gossypii,* and *Schizophyllum commune.*

Diseases of the vegetative or reproductive systems [of cotton in Sao Paulo], R. AVERNA-SACCÁ (*Bol. Agr. [Sao Paulo], 21. ser., No. 4–5, (1920), pp. 293–311, figs. 4*).—This account of cotton diseases includes gummosis (bacterial) connected with *Pleospora gossypii* (*Alternaria tenuis*) and a discussion of protective methods.

Malformation of the cotton plant leading to sterility, G. L. KOTTUR and M. L. PATEL (*Agr. Jour. India, 15 (1920), No. 6, pp. 640–643, pls. 3*).—A malformation of cotton said to be obscure as to causation is claimed to be present in almost all parts of western India. The plants show different forms and degrees of this trouble, which lowers economic returns in different ways. American and Egyptian cottons appear to be free from the disease. Among indigenous Indian cotton the *herbaceum* varieties are by far the most severely affected. The trouble is affected by seasonal conditions. No evidence involving heredity of the disease was obtained. A change in root development is apparent in the malformed plants.

Flax diseases, J. WESTERDIJK (*Jahresber. Ver. Angew. Bot., 16 (1918), No. 1, pp. 1–8*).—Notes are given of recent information regarding flax smut (*Asterocystis radicis*), rust (*Melampsora lini*), anthracnose (*Glocosporium lini*), Botrytis rot (*B. cinerea*), and dead stalk (*Phoma* sp.) of flax.

[Jute chlorosis], G. P. HECTOR (*Agr. Research Inst. Pusa, Sci. Rpts., 1919–20, pp. 55–57*).—This portion of a more extended report by the botanist, dealing with jute chlorosis, states that chlorotic plants never breed pure but always throw greens. Green plants breed practically pure, but generally throw chlorotics, the percentage of which from either parent is not constant.

By constantly selecting chlorotics and breeding from these, a race of practically pure chlorotics can be produced. The same is true of greens, but no absolutely pure race of either has ever been obtained. The facts tend to show that this is possibly a case of maternal inheritance, the disease being passed on from the cytoplasm of the egg cell. Further studies are in progress.

A chlorosis very similar to that in jute prevailed in Pusa. Other crops are to be studied in this connection.

Experiment in the eradication of onion smut (*Gard. Chron., 3. ser., 68 (1920), No. 1757, pp. 103, 104*).—The Ministry of Agriculture conducted trials on ground infected with onion smut in the northeast of England. Weak formaldehyde (1 pint of the 40 per cent strength in 16 gal. of water) was applied to the seeds in the drill at sowing time at the rate of 1 gal. to 150 linear feet. A decided reduction of smut occurred, but the trials are to be repeated.

The white rot disease of onion bulbs, A. D. COTTON and M. N. OWEN (*Jour. Min. Agr. [London], 26 (1920), No. 11, pp. 1093–1099, pls. 2*).—Onion white rot has been studied for two years and is said to be due to a fungus which is classed as a Sclerotium. It is spread by the sclerotia which persist in the soil for a long but unknown period. The disease is liable to be confused with that due to *Botrytis allii.* Control measures are discussed.

Potato diseases, G. R. Bisby (*Minn. Farmers' Inst. Ann., No. 32 (1919), pp. 78–84, figs. 5*).—A key to Minnesota potato diseases is followed by discussion of a few as regards prevention.

Potato diseases, E. Marchal (*Jour. Soc. Natl. Agr. Belg., 1 (1919), Nos. 1, pp. 8, 9; 4, pp. 44, 45*).—An account is given of potato diseases occurring in Belgium since the outbreak of the world war, with a discussion of appropriate protective measures.

The toll of potato diseases, G. R. Bisby and F. J. MacInnes (*Minn. Farmers' Inst. Ann., No. 32 (1919), pp. 75, 76*).—Tabular data with discussion are given regarding storage and field diseases injurious to potato interests during 1918.

Potato scab and type of soil, G. H. Coons (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 132–134, fig. 1*).—The author offers an explanation as to why potato seed treatment for scab is not always successful on limestone soils. Most of the potato crop of the State is produced on soil that tends to become acid, but in the northern part of the State there are considerable areas of limestone soil which show a high percentage of scab on potatoes in spite of treatment.

Attention is called to the fact that alkalinity favors growth of the potato scab organism, and promising results are said to have been obtained with the use of sulphur and other substances, together with the proper selection of fertilizers and the use of green crops turned under on alkali soils. The effectiveness of seed treatment is said to depend upon the soil reaction.

The relation of sulphur to soil acidity and to the control of potato scab, W. H. Martin (*Soil Sci., 9 (1920), No. 6, pp. 393–408, figs. 5*).—Though potato scab (*Actinomyces chromogenus*) was not entirely eliminated even by the heaviest applications of sulphur (400 to 1,200 lbs. per acre), all amounts of 300 lbs. or more gave substantial gains in the number of clean tubers. In all cases, sulphur increased soil acidity, usually in proportion to the amount of sulphur added. It appears that the limiting exponent for the growth of the scab organism is lower in soil than in culture media.

The potato wart disease, J. J. Christensen and G. R. Bisby (*Minn. Farmers' Inst. Ann., No. 32 (1919), pp. 85–90, figs. 4*).—The history of potato wart disease (*Chrysophlyctis endobiotica*) is briefly given, with an account of the territory menaced thereby, which apparently does not now include Minnesota.

Catalase, hydrogen-ion concentration, and growth in the potato wart disease, F. Weiss and R. B. Harvey (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 589–592*).—Investigations carried on in the Bureau of Plant Industry, U. S. Department of Agriculture, are reported upon in which a study was made of hydrogen-ion concentration and catalase activity of the wart disease of the Irish potato, caused by *Chrysophlyctis endobiotica*.

The hydrogen-ion concentration of diseased tissues was found constantly greater than that of healthy tubers from the same plant. Catalase activity was also much greater in the wart tissue, and was found to be strongly correlated with growth in spite of the higher acidity of the proliferation. This is said to differ from other types of plant overgrowths previously studied in which diminished acidity was correlated with increased catalase and growth activity. Differences in acidity of the varieties were not found to be associated with immunity to the disease.

Fungus diseases [of rice, Gao], P. Correia Afonso (*Bol. Agr. [Portuguese East Indies], 1 (1919), No. 2, pp. 124–126*).—Rice diseases discussed in this portion of a more extended report include *Ustilaginoidea virens*, *Tilletia horrida*, *Sclerotium oryzae*, and *Piricularia oryzae*.

[Sugar cane diseases], H. P. AGEE (*Hawaii. Sugar Planters' Assoc., Proc., 39 (1919), pp. 153–156*).—Lahaina disease is discussed in connection with a similar disease in the pineapple fields of Hawaii and Kauai. The exact relationship of an associated parasitic organism has not yet been settled, but it is considered a primitive parasite closely related to the protozoa. A taro rot may be due to the same organism. Two varieties of cane and several seedlings are mentioned as immune.

Nematodes also cause injury and are considered as increasingly dangerous. Yellow stripe continues to do serious injury at points named. Eye-spot disease has done little harm, apparently owing to dry weather. Pahala blight is thought to be a physiological disease, due to absorption of deleterious substances. New local cane diseases are noted, including what is supposed to be sereh, a new leaf disease (*Cercospora sacchari* ?), and a new leaf-sheath spot (*Phyllosticta* n. sp.), which is under investigation.

[Sugar cane leaf stripe disease] (*Hawaii. Sugar Planters' Assoc., Proc., 39 (1919), pp. 196–202*).—This includes discussions by workers contributory to a knowledge of sugar cane leaf stripe disease, which has been associated with a parasitic fungus.

[A new sugar cane disease resembling sereh], C. A. B[ARBER] (*Internatl. Sugar Jour., 22 (1920), No. 255, pp. 139, 140*).—A sugar cane disease apparently new and somewhat resembling sereh is briefly discussed. It is supposed to be due to attack by a fungus entering the young shoot about half way up, where it is no longer protected by the older leaves. It then eats its way across, killing the upper part of each leaf at that point.

The mosaic disease of sugar cane in Trinidad, C. B. WILLIAMS (*Trinidad and Tobago Dept. Agr. Bul., 19 (1920), No. 1, pp. 30–37*).—This disease, now widely distributed and of unknown causation (though known to be transmissible by the corn aphis) and subject to control by no curative measures so far known, appeared in Trinidad early in 1918 at the St. Augustine Experiment Station. It has been located at about 50 points in the island, but from several it has apparently been exterminated. Continual inspection and destruction of all diseased canes and stools, according to plans outlined, constitute the only protection available, these being effective when the infection does not run above 25 per cent.

Investigation of dry rot in swedes, E. B. LEVY (*New Zeal. Jour. Agr., 19 (1919), No. 4, pp. 223–228*).—Trials to determine control measures for swede dry rot were inaugurated in 1918 and carried out at four centers in Southland, where the loss caused by the disease was considerable. The work was divided into manurial, variety, and seed-origin trials, the results for each being presented in tabular form. It is noted that the better the crops in an effected area the more subject they are to the disease. The variety test indicates that while no swede is immune, some are measurably resistant. Seed of different origin showed some differences in susceptibility.

Reduction in the strength of the mercuric chlorid solution used for disinfecting sweet potatoes, J. L. WEIMER (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 575–587*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author gives the results of experiments conducted to determine the rate of reduction in the strength of the mercuric chlorid solution used for treating sweet potatoes, and to work out a method of procedure whereby growers might economically maintain the solution at its original strength.

It was found that a bushel of sweet potatoes, when treated in 32 gal. of a 1:1,000 mercuric chlorid solution in the manner usually recommended, reduced the strength of the solution approximately 1 per cent. The addition of from

0.4 to 0.5 oz. of mercuric chlorid and sufficient water to make the solution up to its original volume after each 10 bu. of sweet potatoes had been treated was found to maintain the solution near enough to its original strength for the treatment of 50 bu. of sweet potatoes.

The decrease in the strength of the mercuric chlorid solution was found to be due in part to the potatoes themselves, and also to the dirt and fibrous roots as well as the containers in which the potatoes were treated. Washed sweet potatoes and Irish potatoes were found to remove approximately the same amount of mercuric chlorid from the solution.

Damping-off of tomato seedlings, W. F. Bewley (*Jour. Min. Agr. [London], 27 (1920), No. 7, pp. 670–673*).—Damping-off in nurseries, said to cause considerable damage, has been shown to be produced by three different organisms, namely, *Phytophthora parasitica*, *P. cryptogea*, and *Rhizoctonia solani*. Conditions and measures for control include a pure and carefully regulated water supply, sterilization of soil, thorough ventilation, and the immediate destruction of all seedlings showing disease.

Blister canker of apple and its control, W. O. Gloyer (*New York State Sta. Bul. 485 (1921), pp. 71, pls. 15, figs. 8*).—Data are presented which demonstrate the pathogenicity of the fungus *Nummularia discreta*, commonly known as the cause of the blister canker on the apple. This disease, which is said to manifest itself in several types of cankers, is usually not economically important in New York, but under certain climatic conditions it may become quite destructive.

Studies were made of natural and artificially induced cankers, both in the greenhouse and in the field, which are described, and the reaction of the host to the fungus is indicated. It is claimed that the fungus may infect the wood parasitically and not show any canker formation, the disease in this case being detected by the appearance of dark brown streaks in the wood which have the odor of that accompanying fermentation. The fungus is disseminated chiefly by means of ascospores discharged the latter part of August, but which may continue to be expelled until the following summer. Generally two years are required for the ascospores to reach maturity.

For the control of blister canker, spraying alone has proved unsatisfactory, and resort must be had to orchard sanitation, pruning, spraying, and covering wounds with a satisfactory dressing.

In addition to the apple, the mountain ash and other hosts must be considered as possible natural sources of infestation and centers of dissemination of the spores.

Control of black spot of pear, L. Paynter (*New Zeal. Jour. Agr., 18 (1919), No. 4, pp. 221–223*).—Records of attempts to control pear black spot (*Fusicladium pyrinum*) at Te Kauwhata by spraying with lime sulphur and with Bordeaux mixture at several different strengths and periods show the least infection for plats receiving the cluster-bud spray in addition to the pink spray.

It is thought that under favorable conditions the heavy cost involved in these treatments could be lessened. However, it is necessary to maintain a covering of the fungicide on the fruit to prevent infection.

Control of brown rot of stone fruits, W. C. Hyde (*New Zeal. Jour. Agr., 19 (1919), No. 1, pp. 24–26*).—Experimentation is detailed as carried out during the season of 1918–1919 to test the previous year's supposedly superior results of spraying stone fruits with Bordeaux mixture as opposed to lime sulphur, and to test the relative merits of lime sulphur, Bordeaux mixture, and self-boiled lime sulphur as a summer spray for the prevention of brown rot in stone fruit trees.

The summer spray is deemed decidedly advantageous. Bordeaux is the best spring spray for stone fruits. Self-boiled lime sulphur is a better summer spray than ordinary lime sulphur for brown rot and other fungi. The use of Bordeaux spray on peach and nectarine trees after the fruit has set is attended with considerable risk.

[Grape diseases, 1914–1918] (*Landw. Jahrb. Bayern, 9 (1919), No. 1, pp. 42–44*).—This portion of the report deals briefly with Peronospora and *Oïdium tuckeri*, injury caused by them, and control measures.

Cryptogamic diseases of cacao and of coconut, R. Averna-Saccá (*Bol. Agr. [Sao Paulo], 21. ser., No. 1–3 (1920), pp. 46–186, figs. 41*).—Organisms here dealt with as regards cacao (*Theobroma cacao*) include *Lasiodiplodia theobromae, Cladosporium theobromicolum, Fusarium decemcellulare, Gloeosporium affine, Pestalozzia guepini, Podosporium theobromicolum, Stilbum* sp., *Pirostroma tetrapsecadiosporium, Physcia integrata sorechiosa* (lichen), *Patellaria theobromatis, Armillaria mellea, Polystictus cinnabarinus, Hendersonia* sp., *Discella cacaoicola*, and *Corticium lilacofuscum*, and as regards coconut (*Cocos nucifera*), *L. theobromae, Pestalozzia palmarum, Diplodia* sp., *Graphiola phoenicis, Leptothyrium* sp., *Gloeosporium* sp., *Verticillium* sp., and *Sphaerodithis neowashingtoniae*. These are dealt with in more or less detail as regards morphology, parasitism, and appropriate control measures.

Sunstroke of cacao trees, Vermoesen (*Bul. Agr. Congo Belge, 11 (1920), No. 1–2, pp. 3–21, figs. 4*).—A descriptive account is given of a cacao disease developing in connection with *Diplodia theobromae* in Mayomba, West Africa.

The red ring or root disease of coconut palms, W. Nowell (*West Indian Bul., 17 (1919), No. 4, pp. 189–202, pls. 9*).—Trinidad root disease, for which the name red ring disease is here proposed, is said to cause the loss of many coconut palms in Trinidad, Tobago, and Grenada. The trees die usually soon after reaching maturity and bearing, but sometimes when 20 years of age. It is thought that the disease may be present as early as the second or third year of tree growth, though outward symptoms appear only in connection with the impending death of the tree. The red ring or zone of the stem, petioles, and roots show the presence of nematodes. The red zone and the organism become less noticeable toward the top of the tree.

Coffee diseases, R. Averna-Saccá (*Bol. Agr. [Sao Paulo], 21. ser., No. 4–5 (1920), pp. 214–219*).—Roots of diseased coffee plants submitted for examination were found to be attacked by a fungus which proved to be *Dematophora necatrix*.

Diseases of orange trees, R. Averna-Saccá (*Bol. Agr. [Sao Paulo], 21. ser., No. 4–5 (1920), pp. 220–222*).—A trunk gummosis of orange, said to be caused by *Bacterium gummis*, is briefly discussed in connection with remedial measures.

Citrus scab, W. V. Tower (*Porto Rico Sta. Rpt. 1920, pp. 24, 25*).—A brief account is given of the observations on citrus scab in a grove in Porto Rico which had received different applications of fertilizers. Scab apparently followed heavy applications of nitrogen, and it is believed that excessive applications of this fertilizing element rendered the trees susceptible to infection through the stimulation of rapid, succulent growth. The author recommends a change in the practice of the application of nitrogen fertilizers, suggesting that they should be applied at intervals throughout the year instead of just before blossoming time, as is the common practice in that region.

Citrus scab, G. L. Fawcett (*Rev. Indus. y Agr. Tucumán, 10 (1920), No. 7–8, pp. 124–128, figs. 3*).—Citrus scab (*Cladosporium citri*), though not discovered by inspectors during 1916–17, was found during 1919 in Tucuman, being abundant in some localities and having been present supposedly for two or three years.

The fungus diseases of the tea leaf, A. C. TUNSTALL and S. C. BOSE (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1920, Nos. 1, pp. 19–25; 2, pp. 37–43, pls. 5*).—The first of these two sections deals with the food of plants, its manufacture and transference, conditions favoring disease, and treatments; the second deals in detail with brown blight (*Glomerella cingulata*) and its treatment.

A Colletotrichum on rosebushes, R. GERMANO DE SOUSA (*Bol. Agr. [Sao Paulo], 21. ser., No. 6 (1920), pp. 374–376, fig. 1*).—A brief account is given of Colletotrichum causing spots on branches of rosebushes.

The South American Hevea leaf disease, G. STAHEL (*Deut. Landb. Suriname Bul. 34 (1917), pp. 111, pls. 29*).—An extended account is given of the Hevea leaf disease caused by *Melanopsammopsis ulei* n. g. (*Dothidella ulei*).

The South American Hevea leaf disease, C. J. J. VAN HALL (*Teysmannia, 30 (1919), No. 5, pp. 210–215*).—This account includes a discussion of the information above noted.

Red rot [of pine], K. MAYER (*Forstwiss. Centbl., 41 (1919), Nos. 4, pp. 121–127; 5, pp. 185–195*).—Facts and figures are presented as gathered during the years 1912 to 1917 regarding pine red rot, the economic importance of which is discussed.

Transference of nematodes from place to place for economic purposes, N. A. COBB (*Science, n. ser., 51 (1920), No. 1330, pp. 640, 641*).—Discussion and suggestions are offered regarding the introduction of promising species of mononchs, with a view to control of other nematodes which are injurious to economic plants.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Information concerning rat surveys and rat-proofing (*Pub. Health Rpts. [U. S.], 35 (1920), No. 45, pp. 2615–2628*).—The importance of rat surveys and rat-proofing for the prevention of the destructive activities of rats against crops and food supplies and the transmission of disease by rats is discussed, and a model ordinance, designed to regulate building with reference to rat-proofing, is given.

Birds of La Plata, W. H. HUDSON (*London: J. M. Dent & Sons, Ltd.; New York: E. P. Dutton & Co., 1920, vols. 1, pp. XVII+224, pls. 11; 2, pp. IX+240, pls. 11*).—This is said to be a simplification of the work entitled Argentine Ornithology, published in 1888–89, by P. L. Sclater and the author. It consists of observations on the birds of the La Plata country, a district of Argentina, and is illustrated by numerous plates in colors.

A method of getting rid of the expensive English sparrow, G. W. SMITH (*Rel. Poultry Jour., 28 (1921), No. 3, pp. 328, 356, figs. 2*).—A description and illustration are given of a practical homemade trap, by means of which as many as 700 sparrows have been captured in a single day. The importance of the English sparrow as a consumer of grain in the field and in the chicken yard and as a disseminator of diseases of poultry is emphasized. It is stated that in the country 50 sparrows will consume at least a quart of wheat daily and destroy at least three times as much as they eat.

Index catalogue of medical and veterinary zoology.—Subjects: Roundworms (Nematoda, Gordiacea, and Acanthocephali) and the diseases they cause, C. W. STILES and A. HASSALL (*Pub. Health Serv., U. S., Hyg. Lab. Bul. 114 (1920), pp. 886*).—This paper includes an authors' bibliography (pp. 32–36), an alphabetical list of specific and subspecific names of roundworms, with cross references to genera and subgenera (pp. 37–172), and a bibliography of supergeneric, generic, and specific names used for roundworms, and of diseases caused by them (pp. 173–881). A list is also given of abbreviations of authors' names and of the names of journals to which reference is made.

Diagnosis of protozoa and worms parasitic in man, R. W. Hegner and W. W. Cort (*Baltimore: Johns Hopkins Univ., School Hyg. and Pub. Health, 1921, pp. 72, figs. 8*).—This is a small handbook prepared for use in the diagnosis of diseases caused by protozoa and worms.

Check list of the insects of Connecticut, W. E. Britton (*Conn. State Geol. and Nat. Hist. Survey Bul. 31 (1920), pp. 397*).—This work lists 6,781 species and varieties, representing 2,946 genera and 333 families that occur in Connecticut.

Eleventh annual report of the State entomologist of South Dakota for the period ending June 30, 1920, H. C. Severin (*S. Dak. State Ent. Ann. Rpt., 11 (1920), pp. 40, figs. 7*).—Included in this report is a brief account of insects injurious to raspberry, blackberry, and dewberry plants in South Dakota.

[Report of the] entomological department (*Panama Canal [Zone] Health Dept. Rpt., 1919, pp. 57–62*).—This report covers the field of medical, sanitary, and economic entomology. It deals with the occurrence of mosquitoes, the spiny citrus white-fly or citrus black-fly, the soft green scale (*Coccus viridis*), which is a serious pest of coffee, and other insects.

Report of the Dominion entomologist and consulting zoologist for the two years 1917 and 1918, C. G. Hewitt (*Canada Dept. Agr., Dominion Ent. Rpt., 1917–1918, pp. 23, figs. 2*).—A general account of the occurrence of insect pests and of investigations conducted, presented largely under the headings of the crops, etc., affected.

The plans of an underground insectary for use in studies of soil-infesting insects are included. This insectary "consists of a concrete pit measuring 10 ft. 6 in. wide, 22 ft. 8 in. long, and 8 ft. 6 in. deep. One-half of this is insulated from the air and constitutes the insectary chamber proper; the cement roof is covered by 3 ft. of earth. The other half forms an entrance chamber, in which experimental material can also be placed. The latter chamber is covered by a wooden entrance building, which permits access to the underground chamber by means of a trapdoor and stairway at all times of the year. A hydrothermograph has been kept in the insectary, and has shown that a very constant degree of temperature and moisture can be maintained and the fluctuations which are experienced above ground can be avoided. A satisfactory method of controlling temperature and moisture conditions, it is expected, will be worked out, and our experience up-to-date is sufficient to demonstrate that this type of insectary offers great possibilities for the study of the life histories and bionomics of soil-infesting insects."

Injurious insects and other animals observed in Ireland during the years 1916, 1917, and 1918, G. H. Carpenter (*Roy. Dublin Soc. Econ. Proc., 2 (1920), No. 15, pp. 259–272, pls. 6, figs. 1*).—The more important insect pests of the period under report are briefly considered.

[Contributions on economic insects] (*Ztschr. Angew. Ent., 7 (1920), No. 1, pp. 224, pls. 2, figs. 73; 7 (1921), No. 2, pp. 471, figs. 22*).—The papers presented in the first of these two numbers (E. S. R., 44, p. 57) include the following: Investigations on the Rape Blossom Beetle [*Meligethes aeneus* Fab.] in Mecklenburg, by K. Friederichs (pp. 1–36); The Resinol Solution as a Spray for Insect Control, by R. Falck (pp. 37–47); Are Some Phyllotreta Species Really Grain Pests? by R. Kleine (pp. 48–57); Observations on the Mediterranean Flour Moth Parasite, *Nemeritis canescens* Grav., being also a Contribution to the Knowledge of the External Anatomy of the Ichneumonids, by P. Krüger (pp. 58–67); Upon the Inclusions of Epithelial Cells of the Intestines of Bees and their Relation to Problems of Digestion, by A. Koehler (pp. 68–91); A Further Contribution to the Knowledge of the Biology of *Bibio hortulanus* L., by E. Molz (pp. 92–96); The Tachinidae as Parasites of Injurious Insects, their Life History, Economic

Importance, and Classification, II, by W. Baer (pp. 97–163); Contributions to the Biology of the Webbing Clothes Moth (*Tineola biselliella*) and its Control by Hydrocyanic-acid Gas, by W. Nagel (pp. 164–171); Use of Arsenicals Against Vineyard and Orchard Pests, by F. Stellwaag (pp. 172–180); and New and Little Known Spider Mites, by F. Zacher (pp. 181–187).

The papers presented in the second number include the following: The Biological Combat of Malaria in Macedonia, by E. Martini (pp. 225–286); The Rôle of Animal Parasites and Disease Transmitters in the East African Campaign, by H. Morstatt (pp. 287–295); Chloropicrin in Insect Control Work, Particularly in Combating the Granary Weevil, by J. Wille (pp. 296–310); The Nonne or Nun Moth Increase in the Hofoldinger Forest from 1899 to 1902, by Rebel (pp. 311–333); Trap-tree Methods for the Different Bark Beetles, by Sedlaczed (pp. 334–339); Control of *Anobium striatum* Oliv. by Use of Hydrocyanic-acid Gas, by W. Nagel (pp. 340–348); and The Tachinidae as Parasites of Injurious Insects, Their Life History, Economic Importance, and Classification, III, by W. Baer (pp. 349–423). The paper by Baer on the Tachinidae includes a systematic index of the hosts and their parasites, arranged by orders. A bibliography (pp. 410–416) and an index to the species, genera, etc., discussed in the papers (pp. 416–423) are included.

Report of the government entomologist for 1918–19, C. C. Gowdey (*Uganda Dept. Agr. Ann. Rpt. 1919, pp. 36–40*).—The author lists the more important insects of the year under the crops on which they occur.

Report of the entomologist, L. J. Newman (*West. Aust. Dept. Agr. Ann. Rpt. 1920, pp. 39–41*).—This consists largely of a discussion of the occurrence of the more important injurious and beneficial insects during the year.

[Economic insects in Fiji], C. H. Knowles (*Fiji Dept. Agr. Ann. Rpt. 1917, pp. 8–12*).—This is a report on the occurrence of the more important insects attacking bananas, coconuts, cacao, citrus, corn, potatoes, ornamental plants, etc.

Some local practices prevalent in South India in the control of insect pests, T. V. Ramakrishna Ayyar (*Agr. Jour. India, 16 (1921), No. 1, pp. 40–51, pls. 3*).—This is a review of control measures commonly practiced in South India.

Report of the proceedings of the third entomological meeting, held at Pusa February 3 to 15, 1919, edited by T. B. Fletcher (*Ent. Meeting Pusa Rpt. Proc., 1919, vols. 1, pp. XII+417, pls. 69; 2, pp. VI+418–835, pls. 60; 3, pp. VI+836–1137, pls. 53*).—Papers presented at the third meeting of official entomologists of India and others are here reported (E. S. R., 39, p. 162). Those in the first volume include Insect Control, by E. A. Andrews (pp. 23–32); Annotated List of Indian Crop Pests, by T. B. Fletcher (pp. 33–314); Some Insects Recently Noted as Injurious in South India, by T. V. Ramakrishna Ayyar (pp. 314–328); Note on the More Important Insect Pests of Planting Districts of South India and the Methods of Control Used, 1917–18, by R. D. Anstead (pp. 328–332); A List of Lepidoptera Noted to Attack Cultivated Plants in Ceylon (pp. 332–337), and A List of Plants With Their Lepidopterous Pests in Ceylon (pp. 337–341), both by R. Senior-White; lists of pests of cereals, pulses, oil-seed plants, tobacco, vegetables, and sugar cane, respectively, in Burma (pp. 341–352, 354) and Notes on Miscellaneous Pests in Burma (pp. 352, 353), all by K. D. Shroff; and Borers in Sugar-cane, Rice, etc., by T. B. Fletcher and C. C. Ghosh (pp. 354–417).

Papers in the second volume include Some Indian Economic Aleyrodidæ (pp. 418–433), The Rice Leafhoppers (*Nephotettix bipunctatus* Fabr. and *N. apicalis* Motsch.) (pp. 433–443), Some Pests of Cotton in North Bihar (pp. 547–561), Index to Indian Fruit Pests (pp. 564–595), Tukra Disease of Mulberry [*Phena-*

coccus hirsutus] (pp. 610–618), and Lac Culture in India (pp. 782–800), all by C. S. Misra; Cotton Bollworms in India, by T. B. Fletcher and C. S. Misra (pp. 443–472); The Pink Bollworm in Egypt, by L. H. Gough (pp. 472–532); Experiments in Egypt on the Survival of the Pink Bollworms (Resting Stage Larvæ) in Ripe Damaged Cotton Bolls Buried at Different Depths, by F. C. Willcocks (pp. 532–547); List of the Pests of Fiber-yielding Plants in Burma (pp. 562, 563), List of the Pests of Fruit Trees (Including Palms) in Burma (pp. 596–600), Notes on Some Land and Marine Crabs and Field Snails which are Pests in Burma (pp. 689–694), Notes on the Red Worms Found in the Ngachima Paddy at Hmawbi (pp. 694, 695), and List of the Pests of Stored Products, Spices, and Drugs in Burma (pp. 762, 763), all by K. D. Shroff; Coccids Affecting Fruit Trees in Southern India (pp. 601–609), and A Note on Our Present Knowledge of Indian Thysanoptera and Their Economic Importance (pp. 618–622), both by T. V. Ramakrishna Ayyar; The Methods of Control of *Agrotis ypsilon* in Bihar, by H. L. Dutt (pp. 622–625); Control of the Melon Fly in Hawaii by a Parasite Introduced from India, by D. T. Fullaway (pp. 625–629); Insect Pests of the Tea Plant in Formosa, by T. Shiraki (pp. 629–669); *Helopeltis theivora* Waterh., by E. A. Andrews (pp. 669–671); Lantana Insects in India, by Y. Ramachandra Rao (pp. 671–680); A Note on Crabs as Pests of Rice (pp. 680–689) and Beekeeping in India (pp. 770–782), both by C. C. Ghosh; Some Problems in Forest Insect Control, by C. F. C. Beeson (pp. 696–704); The Preservation of Wood Against Termites (pp. 705–712), and Stored Grain Pests (pp. 712–761), both by T. B. Fletcher and C. C. Ghosh; Mercury as an Insecticide (abstract), by K. Kunhi Kannan (pp. 761, 762); Potato Preservation in the Bombay Presidency, by R. S. Kasergode (pp. 763–770); The Pusa Experiments on the Improvement of Mulberry Silkworms (pp. 800–808), and The Best Method of Eliminating Pebrine from Multivoltine Silkworm Races in India (pp. 809–835), both by M. N. De; Pebrine in India, by C. M. Hutchinson (p. 808); and Exhibition of Specimens and Drawings of Indian Wild Silk Moths, by C. M. Inglis (p. 835).

Papers in the third volume include The Life History of *Caligula cachara*, by J. H. Watson (pp. 836–838); Life Histories of Microlepidoptera (abstract) (pp. 838–857), Hints on Collecting and Preserving Insects (pp. 936–974), Note on a Very Curious Geometrid Larva (pp. 978, 979), Indian Epipyropidae (pp. 979–982), Indian Fossil Insects (pp. 983–990), The Desirability and Practicability of the Preparation and Publication of a General Catalogue of All Described Indian Insects (pp. 990–999), and Note on Plant Imports into India (pp. 1052–1070), all by T. B. Fletcher; Exhibition of Drawings of Early Stages of Indian Butterflies, by F. C. Fraser (p. 857); The Life History of *Orthezia insignis* (abstract) (pp. 857, 858), and The Function of the Prothoracic Plate in *Bruchus chinensis* (abstract) (pp. 858, 859), both by K. Kunhi Kannan; Some Insect Prey of Birds in the Central Provinces, by E. A. D'Abreu (pp. 859–871); Some Notes Toward the Life History of *Comocritis pieria* Meyr., by R. Senior-White (pp. 872–875); Notes on Rearing Insects in Hot Climates, by T. B. Fletcher and C. C. Ghosh (pp. 875–892); Breeding Cages and General Insectary Technique for Wood Borers (pp. 892–895), and Note on the Decimal Method of Subject Indexing Entomological Literature (pp. 1048–1051), both by C. F. C. Beeson; Notes on Night-flying Dragonflies (pp. 895–897), Note on the Larvæ of *Catochrysops strabo* Feeding on Cycas (pp. 897, 898), and Spiders as Checks on Lepidopterous Larvæ (pp. 898–900), all by F. C. Fraser; The Comparative Invisibility of *Papilio demoleus* During Flight (pp. 900–903), and A Method of Preserving Butterflies and Other Insects (pp. 974–976), both by E. H. Hankin; The Proportions of the Female Forms of *Papilio polytes* L. in the Different Parts of Its Geographical Range, by E. B. Poulton (pp. 903–906);

The Importance of Insects to Fisheries, by B. Prashad (pp. 906–909); Note on a Musciphagous Wasp (*Bembex lunata*) (pp. 909, 910), Notes on the Life History of *Cantao ocellatus* Th. (pp. 910–914), Notes on the Life History of *Polyptychus dentatus* (pp. 914–918), Notes on the Life History of the Pollu Flea-beetle (*Longitarsus nigripennis* Mots.) of Pepper (pp. 925–928), On the Insect Parasites of Some Indian Crop Pests (pp. 931–936), Notes on Two Psyllid Galls Exhibited, with Remarks on Indian Psyllidae (pp. 1030, 1031), Note on Some Swarming Fulgorid Bugs (pp. 1032, 1033), and Eumastacinæ from South India (pp. 1033, 1034), all by T. V. Ramakrishna Ayyar; Some Observations on the Life History of an Erotylid Breeding in Italian Millet (pp. 919–921), and Some Recently Noted South Indian Melolonthidae of Economic Importance (pp. 1028, 1029), both by P. V. Isaac; The Life History of the Moringa Stem Borer, by T. V. Subramaniam (pp. 922–925); On Some of the Bionomics of Bruchidae (Lariadae), by R. S. Kasergode (pp. 928–931); The Importance of Collecting, by D. Sharp (pp. 976–978); A Sketch of Our Present Knowledge of Indian Microlepidoptera, by E. Meyrick (pp. 999–1009); The Trichonymphid Parasites of Some Indian Termites, by F. de Mello (pp. 1009–1022); Genitalia of Some Ceylonese Hesperiadae, by W. Ormiston (pp. 1022–1025); On the Bollworm Parasite Described as *Rhogas lefroyi* by Dudgeon and Gough, by C. T. Brues (pp. 1026–1028); Suggestions Regarding Publication of Communications on Entomological Subjects (pp. 1034–1042), and Some Aspects of Economic Entomology in India (pp. 1073–1081), both by C. C. Ghosh; The Preparation and Reproduction of Scientific Illustrations, by A. W. Slater (pp. 1043–1048); Entomological Education in Agricultural Colleges (pp. 1070–1073); and The Organization of Entomological Work in India (pp. 1081–1094).

A subject index of 37 pages is included.

Insect enemies of cotton and means for their control, L. A. Catoni (*Rev. Agr. Puerto Rico, 6 (1921), No. 3, pp. 25–31*).—This is a brief summary of information.

Scar damage done to apples and pears by insects, F. V. Theobald (*Fruit, Flower, and Veg. Trades' Yearbook, 1921, pp. 25–27, figs. 8*).—This is a brief account illustrated by drawings showing the scars of fruit caused by different pests.

Some notes on the fruit worms of British Columbia, R. C. Treherne (*Sci. Agr., 1 (1921), No. 3, pp. 116–119, figs. 4*).—This paper, accompanied by illustrations, has been prepared for use in the ready determination of larval identity of various fruit-infesting larvae attacking orchard trees in Canada.

The food plants of Indian forest insects, C. F. C. Beeson (*Indian Forester, 45 (1919), Nos. 2, pp. 49–56; 3, pp. 139–153; 6, pp. 312–323; 9, pp. 488–495*).—In this list the families and species of insects are arranged in alphabetical order, both the common and scientific names of the host plants of each species being given.

Sanitary entolomogy: The entomology of disease, hygiene, and sanitation, edited by W. D. Pierce (*Boston: Richard G. Badger, 1921, pp. XVI+19–518, figs. 150*).—The present work is based upon lectures prepared for use by a class formed in May, 1918, for the purpose of preparing its members for service during the war, the lectures having been revised up to the date of March 1, 1919. The book, which consists of 35 chapters, includes a tabulation which shows the relation of insects to the transmission of diseases (pp. 473–497). In the preparation of the work the author was assisted by C. T. Greene, R. H. Hutchison, B. H. Ransom, F. C. Bishopp, J. L. Webb, G. H. Lamson, jr., A. N. Caudell, H. A. Ballou, and E. W. Laake.

The biology of North American caddis-fly larvae, J. T. Lloyd (*Lloyd Libr. Bul. 21 (1921), pp. 124, figs. 197*).—This work includes a list of the more important writings on the immature stages of North American Trichoptera.

Control of the pear thrips, C. R. Phipps (*New York State Sta. Bul. 484 (1921), pp. 3–11, pls. 5*).—In work at Geneva during the past two years, the best results have been obtained with either miscible oil or whale-oil soap, 5 lbs. to 1 pint nicotin sulphate and 100 gal. water. The killing power of a high-grade miscible oil is very great, for death immediately follows contact with the spray. Although soap has given fairly good results, its killing power is slightly less than that of oil, and the penetrative power is only moderate.

The experiments have demonstrated that while the pear thrips is a difficult pest to combat, since it appears suddenly, enters the buds quickly, and requires prompt and very thorough spraying, yet it can be effectively controlled by spraying. The critical period for successful spraying begins with the emergence of the adults and continues until the buds open. Three or even four sprayings may be advantageously employed, one or two when the adults first appear, a third when the blossoms are in the cluster-bud stage, and a fourth against the larvae when the petals are falling. An outfit capable of maintaining a pressure of from 200 to 300 lbs. should be used.

New Thysanoptera from Florida, VI–VIII, J. R. Watson (*Fla. Ent., 4 (1920), Nos. 1, pp. 13; 2, pp. 18–23, 27–30; 4 (1920), No. 3, pp. 35–39*).—This continuation of the papers on Florida thrips, previously noted (E. S. R., 41, p. 847), includes keys for the separation of Hoplandrothrips, Chirothrips, Heterothrips, Eurythrips, and Haplothrips. The genera Myrmecothrips and Dolichothrips are erected, and nine species are described as new.

Essay on the American species of Aradus (Hemiptera), H. M. Parshley (*Trans. Amer. Ent. Soc., 47 (1921), No. 1, pp. 106, pls. 7*).—This is a synopsis of the genus Aradus, of which 60 forms are recognized.

Hopperburn of potato and its control, J. E. Kotila (*Michigan Sta. Quart. Bul. 3 (1921), No. 4, pp. 128–131, figs. 3*).—It is pointed out that experiments at the Upper Peninsula Substation, at Chatham, Mich., during the 1919 and 1920 seasons, as well as at other experiment stations, have proved conclusively that the potato leafhopper is the cause of hopperburn, formerly termed "tipburn."

This leafhopper passes the winter, under Michigan conditions, in the adult stage, hibernating in trash along fence rows or among the leaves in the wood lot. There are two complete generations and a partial third on potatoes in Michigan each year. The use of Bordeaux mixture as a repellant of the pest is recommended, four applications to be made at the rate of 5:5:50.

A study of the behavior of carbon disulphid when injected into the soil and its value as a control for the root form of the woolly apple aphis, B. R. Leach (*Soil Sci., 10 (1920), No. 6, pp. 421–451, pls. 2, figs. 8*).—This is a report of experimental work conducted in Maryland, Virginia, and West Virginia during the seasons of 1915 and 1916, with a view to determining the actual value of carbon disulphid as a control measure for the woolly apple aphis.

The results show that aphids infesting roots growing near the surface of the soil, or in decomposed trash at the surface of the soil, escape the action of the fumes, and the aphids thus escaping serve as a source of reinfestation. Were it not for the injury arising from the use of the material, young apple trees infested with woolly apple aphis could be maintained in a vigorous condition with one annual treatment at the most, for the number of aphids would be so reduced as to render the injury caused by them negligible.

"The conditions which influence the diffusion of carbon disulphid in the soil are, first, the soil type; second, the soil mixture; and third, the depth and arrangement of the dosage holes. Of these three factors, the moisture

content of the soil is the limiting one. Variations in atmospheric or soil temperature throughout the growing season apparently do not affect the attainment of maximum diffusion, and for this reason it can be secured at any time during the growing season when soil-moisture conditions are favorable. It was found impossible to apply carbon disulphid at any time during the year when soil conditions were favorable without causing injury to the apple tree. Direct injury resulted to the roots and indirect injury to the branches and foliage, apparently due to the interference with normal transpiration."

The American blight or the woolly aphis, Eriosoma (Schizoneura) lanigera Haus., C. S. MISRA (*Agr. Jour. India, 15 (1920), No. 6, pp. 627–635, pls. 5*).—An account of this pest, particularly as relates to its occurrence in India.

The woolly aphid of the apple and elm, I, F. V. THEOBALD (*Jour. Pomol., 2 (1921), No. 2, pp. 73–92, pls. 5, figs. 2*).—This is a report of biological studies in England, with references to the literature. The author has followed its life cycle on elm and apple and found it to be the same in England as reported by Patch for this country (E. S. R., 36, p. 755). In England he has found it on *Ulmus campestris, U. montana,* and two other species. Notes on the woolly aphid of the pear and the woolly aphids of the hawthorn are appended.

Observations on the control of black scale in Chula Vista, E. L. PRIZER (*Calif. Citrogr., 6 (1921), No. 7, pp. 244, 252, 253, figs. 2*).—This is a discussion of the control of the black scale in the moist climate of the Chula Vista region along San Diego Bay, where the pest is most prolific and where climatic conditions cause two well-defined hatches. It is concluded that the two hatches do not justify the application of control measures without careful inspection of the orchard to be treated, since the seasonal hatch may have been interfered with by previous artificial control. A report of investigations of the black scale, by Quayle and Rust, has been noted (E. S. R., 26, p. 554).

Seasonal history of black scale and relation to biological control, H. COMPERE (*Calif. Citrogr., 6 (1921), No. 6, p. 197, fig. 1*).—This is a popular account of the black scale and of its natural enemy *Aphycus lounsburyi.*

Report upon a collection of Coccidae from Lower California, G. F. FERRIS (*Stanford Univ. Pubs., Univ. Ser., Biol. Sci., 1 (1921), No. 2, pp. 59–132, figs. 52*).—This report is based upon results of collections by the author and an associate made in the southern portion of the peninsula during the summer of 1919. Eighty-five species of Coccidae are listed, of which 79 are from the Cape Region and 29 are described as new. The genera Steatococcus and Xerococcus are erected.

The European horse-radish webworm, F. H. CHITTENDEN (*U. S. Dept. Agr. Bul. 966 (1921), pp. 10, figs 8*).—The European horse-radish webworm (*Evergestis straminalis* Hübn.) was first discovered in injurious numbers in Virginia near the District of Columbia in 1919, prior to which time reports of its injurious occurrence had been nearly all confined to the maritime Provinces of Canada, although attack had been noted occasionally in Massachusetts, New York, New Jersey, and Wisconsin. It is pointed out that this species makes the third specific enemy of horse-radish inhabiting North America, the other two being the introduced horse-radish flea-beetle (*Phyllotreta armoraciae* Koch) and the native horse-radish webworm (*Plutella armoracia* Busck). There are two other webworms that affect horse-radish in this country, both introduced from abroad, namely the imported cabbage webworm and the diamond-back moth.

Technical descriptions are given of *E. straminalis* in its several stages, and notes on its distribution, occurrence and habits, natural enemies, etc., are presented. It is a native of the Old World, being found in Great Britain and Ireland. It is known to occur in Cape Breton Island, Quebec, and Nova Scotia

in Canada, and in Massachusetts, New Hampshire, New York, New Jersey, Illinois, Wisconsin, the District of Columbia, and Virginia.

In Europe the species has been recorded as feeding in confinement on wild plants of the genera Barbarea, Sinapis, and Cardamine. It was recorded by Harris on horse-radish and turnip and by Fletcher as attacking these plants and cabbage in Canada.

The larva is a greenish caterpillar with reddish or purplish tints, measuring, when full grown, about 0.75 in. in length. It feeds on the lower surface of the leaves, which it frequently webs together near the ground, and also attacks the stalks. "It passes the winter as a larva in an earth-covered pupal case near the surface of the ground and the moths appear some time in May. In Virginia the eggs hatch in 7 or 8 days, and the larvae begin by feeding on the leaves, when abundant attack the stalks, and attain full growth in about 3 weeks. They then transform to pupae and about three weeks later produce another brood of moths, making an approximate life cycle of 7 or 8 weeks, depending on temperature. At least two generations a year are produced in Virginia."

A single parasite, *Bracon montrealensis* Morr., was reared from the larva at Arlington, Va., September 6, 1919. The pest may be controlled by arsenicals and by hand picking on horse-radish and, more readily on other crops, by fall and spring plowing and frequent cultivation.

Pink bollworm notes (*Agr. News* [*Barbados*], *20* (*1921*), *No. 494, p. 106*).—It is stated that the pink bollworm has now appeared in Nevis and in St. Croix of the Virgin Islands, making four islands in the Leeward Islands and the Virgin Islands groups in which this insect now occurs.

Life histories of Indian insects, Microlepidoptera, T. B. Fletcher (*India Dept. Agr. Mem., Ent. Ser., 6* (*1920*), *No. 1–9, pp. II+217, pls. 68, fig. 1*).—The author here brings together the present status of knowledge of Microlepidoptera occurring in India. It is stated that in the present and subsequent papers the early stages of 396 species will be dealt with. Many of the species and the nature of their injury are illustrated in colors.

The mosquitoes of New Jersey and their control, T. J. Headlee (*New Jersey Stas. Bul. 348* (*1921*), *pp. 229, figs. 131*).—This is a revised edition of Bulletin 276, previously noted (E. S. R., 34, p. 64).

The early stages of Tabanidae (horseflies), W. Marchand (*Rockefeller Inst. Med. Research Monog. No. 13* (*1920*), *pp. 203, pls. 15*).—This is a report of investigations by the department of animal pathology of The Rockefeller Institute for Medical Research, at Princeton, N. J. The results are presented under the headings of history of investigations, description of early stages, bionomics, special anatomy of larvae, unidentified species of Tabanus, parasites of the early stages of Tabanidae, notes on methods of rearing and studying tabanids in early stages, etc. A bibliography of four pages and a statistical table of results on early stages are included.

Further notes on Ambopogon hyperboreus Greene (Diptera), C. T. Greene (*Ent. Soc. Wash. Proc., 23* (*1921*), *No. 5, pp. 107–109*).

A preliminary catalogue of the Siphonaptera of Switzerland, K. Jordan and N. C. Rothschild (*Ectoparasites, 1* (*1920*), *No. 2, pp. 78–122, figs. 27*).—Fifty-one forms are described as occurring in Switzerland. A list of 47 hosts and their flea parasites is included.

Genotypes of the elaterid beetles of the world, J. A. Hyslop (*U. S. Natl. Mus. Proc., 58* (*1921*), *pp. 621–680*).

Report on operation for the control of Phytalus smithi during the season 1919–20, H. A. Tempany (*Mauritius:* [*Dept. Agr.*], [*1920*], *pp. 4*).—This is a report of work with *P. smithi*.

Temperatures fatal to larvæ of the red-headed ash borer as applicable to commercial kiln drying, F. C. CRAIGHEAD and W. K. LOUGHBOROUGH (*Jour. Forestry, 19 (1921), No. 3, pp. 250–254*).—The authors' study led to the conclusion that the larvæ of the red-headed ash borer (*Neoclytus erythrocephalus* Fab.) are killed in any kiln process which can be considered practical for the seasoning of ash, regardless of the thickness. "Even temperatures as mild as those used in Schedule 2, Specification 20,500 A, Bureau of Aircraft Production, which range from 105 to 135° F., are fatal to them. Subjecting infested material to a temperature of 116° for 45 hours resulted in 100 per cent death of the larvæ. Temperatures of about 125 to 130° will kill the larvæ within an hour after the wood becomes heated through.

"Dry heat is fatal to the larvæ at a lower temperature than hot water for the same period. Water at 125° for an hour was fatal to only 75 per cent of the larvæ treated, while dry air at 125° resulted in 100 per cent death in two minutes. The time required to produce 100 per cent death in dry air at 120° was 10.5 minutes, while the same effect was produced in water only after 2.5 hours. These time limits are not to be considered absolute limits, but merely to show in a general way that dry air is much more effective than water in producing the death of the larvæ at lower temperatures.

"In the dry-air experiments several larvæ of *Xylotrechus colonus* Fab. from hickory were used, and the effects were similar to those produced on *N. erythrocephalus*. Although it is hardly likely that these same temperatures will be equally fatal to other insects, such as those native to the Southern States, it is probably safe to assume that if commercial kiln schedules above Schedule 2 are used on other woods, other species of borers that may be in the wood will be killed."

Hoplocerambyx and the dying off of sal, C. F. C. BEESON (*Indian Forester, 47 (1921), No. 2, pp. 68–76, pl. 1*).—Investigations reported indicate that *H. spinicornis* Newm. is essentially a secondary factor in the loss of sal trees, but that under epidemic conditions this borer may cause the death of weakened trees.

Dusting cotton for the control of the boll weevil, D. C. WARREN (*Ga. State Bd. Ent. Bul. 56 (1920), pp. 16, figs. 3*).—This is a report of dusting experiments conducted on several plantations in the vicinity of Valdosta, Ga., during the year 1919. Calcium arsenate at the rate of 5 lbs. per acre was applied by means of horsedrawn motor driven Niagara machines, from 4 to 9 applications being made. In one field the calcium arsenate was mixed with lime at the rate of about 1:6 of lime, and in another field zinc arsenite was used.

The dusting proved profitable in practically all of the tests, although the profit was not large in any case, $10.24 per acre being the largest amount. On two plats where the dusting was not started until August 1 there was no increase in yield. Directions for applying the poison are included.

Reports of dusting work with the boll weevil by Ward in Georgia (E. S. R., 43, p. 456), Hinds and Thomas in Alabama (E. S. R., 45, p. 60), Watkins in Texas (E. S. R., 43, p. 462), and by Coad and Cassidy in the Mississippi Delta (E. S. R., 43, p. 856) have been noted.

Fighting alfalfa weevil, C. WAKELAND (*Idaho Agr. Col. Ext. Bul. 50 (1921), pp. 27, figs. 9*).—This is a summary of information on the nature of the injury of this pest, its occurrence, and means of control.

Ants in dwellings: A method of destroying these troublesome pests, E. MCDANIEL (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 127, 128*).—It is pointed out that for control purposes the ants that infest houses in Michigan may be divided into two classes, namely, those that like sweets, including the large carpenter ants and several species of brown ants of varying size, and

those that like grease, or the very tiny red ants. In order to permanently rid a dwelling of these nuisances it is necessary that their nests be destroyed, and this is most easily accomplished by inducing the ants to do the work themselves. For the sweet-loving ants a mixture of tartar emetic and extracted honey at the rate of 1 part of the poison to 20 of the honey is recommended. The grease-eating species may be controlled by working a small amount of tartar emetic into bacon rind, or by using one part tartar emetic to 20 parts of grease.

A beehive designed for the production of beeswax suitable for use by natives of the southern Sudan, H. H. KING ([*Wellcome Trop. Research Lab.*] *Ent. Bul. 11 (1920), pp. 11, pl. 1*).—This is an account of a variety of the honey-bee (*Apis mellifica unicolor adansoni*), which occurs commonly throughout the central and southern provinces of the Anglo-Egyptian Sudan, and of the means by which production of and trade in beeswax may be stimulated.

The males of the ichneumonid genera Myersia and Thaumatotypidea, with descriptions of new species (Hym.), R. A. CUSHMAN (*Ent. Soc. Wash. Proc., 23 (1921), No. 5, pp. 109–112, fig. 1*).

Remarks on the genus Pleurotropis, with description of a parasite of Trachelus tabidus Fab. (Hymenoptera: Chalcidoidea), A. B. GAHAN (*Ent. Soc. Wash. Proc., 23 (1921), No. 5, pp. 113–120, figs. 2*).—The species *P. benefica*, which attacks the black grain-stem sawfly, *T. tabidus* (E. S. R., 43, p. 363), is described as new.

New reared parasitic Hymenoptera from the Philippines, A. B. GAHAN (*Philippine Jour. Sci., 17 (1920), No. 4, pp. 343–351*).—Species here described include *Homalotylus mundus* reared from *Pseudococcus virgatus* Ckll., *Taftia saissetiae* reared from *Saissetia hemisphaerica* Targ., *Acroclisoides luzonensis* reared from *Tectocoris lineola* Fab., *Elasmus albomaculatus* reared from *Acrocercops* sp., *Pleurotropis anomala* reared from *Endelus bakeri* Kerr., and *Aphanurus banksi* reared from *Tectocoris lineola* Fab., all in Luzon.

FOODS—HUMAN NUTRITION.

Physiology and national needs, edited by W. D. HALLIBURTON (*London: Constable & Co., 1919, pp. VII+162*).—This volume consists of six lectures which were delivered at King's College, London, during 1919, on various aspects of the relation of physiology to national needs. The subjects and authors are as follows: Physiology and the Food Problem, by W. D. Halliburton; Vitamins, Unknown but Essential Accessory Factors of Diet, by F. G. Hopkins; Scurvy, A Disease due to Absence of Vitamin, by A. Harden; Physiology in the Study of Disease, by D. N. Paton; The Conservation of our Cereal Reserves, by A. Denby; and Physical Training and the Open-air Life, by M. S. Pembrey.

Processes of flour manufacture, P. A. AMOS (*London and New York: Longmans, Green & Co., 1920, 2. ed., pp. XII+280, pl. 1, figs. 115*).—This is a reprint of the 1915 (second) edition of this book, the first edition of which has been previously noted (E. S. R., 29, p. 263).

On rope (and sourness) in bread, together with a method of estimating heat-resistant spores in flour, D. J. LLOYD, A. B. CLARK, and E. D. MCCREA (*Jour. Hyg. [Cambridge], 19 (1921), No. 4, pp. 380–393*).—This report of an investigation of rope in bread includes a brief literature review; the results obtained in the isolation of causative organisms from bread, flour, and grains, and in the study of the chemical changes produced in bread by these organisms; a method of estimating heat resistant spores in flour, and the distribution of the spores in flour, flour mills, and baking houses; and a study of conditions controlling the development of rope.

Six strains of *Bacillus mesentericus* were isolated from grains and flour, and five of these were also isolated from ropy bread. Some of these strains produced an acid and others an alkaline reaction in bread. There appeared to be a close relation between the reaction produced and the destruction of the bread proteins. Those which produced a slight shift of reaction toward the alkaline side had very little proteolytic power, while those causing an alkaline reaction were strongly proteolytic. An increase in reducing sugar was noted in bread infected with some of the strains.

The principal factors concerned in the growth of these organisms and the development of rope in bread are the degree of infection, moisture, temperature, reaction of the bread, and composition of the flour. The optimum reaction for growth was found to be at pH=6.5, the reaction of normal bread, while the inhibitory reaction is at pH=5.5, a reaction considered desirable for the optimum condition of the gluten but difficult of attainment in bakehouse practice. Whole meal flour was found to afford the best medium for growth of *B. mesentericus*, 90 to 80 per cent proving less favorable and 70 per cent still less favorable.

Studies on the control of rope in bread (*Amer. Inst. Baking Bul. 5 (1921), pp. 18*).—A study is reported of the effect of the addition to flour of various acids and acid salts to prevent the formation of rope.

The H-ion concentration most favorable for the inhibition of rope was found to be slightly higher than pH=5. While it was found difficult to produce bread of good quality and at the same time maintain a satisfactory H-ion concentration, fairly good results were obtained with the use of various combinations of dihydrogen potassium phosphate and acid sodium sulphate. Inoculated dough from patent and blend flours responded more readily to such treatment than the dough from clear flour. A table is given of the varying combinations of the two salts used, with the resulting pH value, quality of bread, and extent of rope formation. A list of 30 references to the literature is appended.

Studies in nutrition.—V, The nutritive value of soy bean flour as a supplement to wheat flour, C. O. Johns and A. J. Finks (*Amer. Jour. Physiol., 55 (1921), No. 3, pp. 455–461, figs. 3*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, reports the results of a series of experiments with soy bean flour similar to those with peanut flour (E. S. R., 43, p. 763). Bread made with a mixture of 25 parts of soy bean flour and 75 parts of wheat flour, or with 15 parts of the former to 85 of the latter, contained a protein mixture and water-soluble vitamin adequate for normal growth. A comparison of the index numbers showing the ratio of the gain in weight to grams of protein digested, following the method of Osborne, Mendel, and Ferry (E. S. R., 40, p. 765), showed that for the same amount of food consumed the soy bean bread diets are about two or three times as efficient as the white bread diets.

Malt soup extract as an antiscorbutic, H. J. Gerstenberger (*Amer. Jour. Diseases Children, 21 (1921), No. 4, pp. 315–326*).—The author reports the rapid and marked cure of three severe cases of infantile scurvy by the administration of 100 gm. daily of malt soup extract, given in two cases in the form of Keller's soup and in one in conjunction with S. M. A. (E. S. R., 42, p. 660). The explanation offered for the presence of vitamin C in this lot of malt soup extract is the probability that the malt was made from a lot of barley possessing an unusually large amount of the vitamin. The possibility is suggested of manufacturing malt soup extract from barley of an age and state of germination that would insure an adequate content of vitamin C.

The vitamin content of honey and honey comb, P. B. Hawk, C. A. Smith, and O. Bergeim (*Amer. Jour. Physiol., 55 (1921), No. 3, pp. 339–348, figs. 6*).—Essentially noted from another source (E. S. R., 45, p. 365). Experiments on the influence of honey upon gastric digestion are also reported which show that the addition of honey to bread does not appreciably delay its digestion.

The available carbohydrate in thrice boiled vegetables, L. O'Reilly and E. H. McCabe (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 83–89*).—Determinations by the taka-diastase method are reported of the carbohydrate content of vegetables boiled three times with 10 and 20 parts of water and with and without the addition of sodium bicarbonate in 0.05 and 0.1 per cent concentration.

The extraction with 20 parts of water removed the carbohydrate more completely than did extraction with 10 parts, but of the vegetables used only vegetable marrow, lettuce, and celery could be completely freed from available carbohydrate. Canned spinach, canned asparagus, turnips, beets, and onions were rendered approximately carbohydrate free, while canned string beans, cauliflower, pumpkin, cabbage, and carrots retained about 0.5 per cent of available carbohydrate after the third boiling. Sodium bicarbonate increased the amount of carbohydrate extracted from most vegetables, particularly cauliflower.

Vegetable fats and oils.—[Soy bean], M. Rindl (*So. African Jour. Indus., 3 (1920), Nos. 6, pp. 518–531; 8, pp. 742–749*).—Included in this compilation of information on the soy bean are a number of recipes in common use in Japan and elsewhere for soy bean preparations, including soy bean milk, curd, and meal, and the fermented products matto (fermented boiled beans), miso (ripened vegetable cheese), and shoyu (soy bean sauce).

The fruits, C. Arnou (*Les Fruits. Paris: Author [1919], pp. 211+2, figs. 77*).—This and the three following volumes belong to the previously noted series on the commercial utilization of fruits (E. S. R., 42, p. 615). In the present volume the author discusses the composition of fruits and the general principles followed in their preservation in the fresh state and by heat, dehydration, and cold storage.

Red fruits, C. Arnou (*Fruits Rouges. Paris: Author [1919], pp. 68+2, figs. 29*).—Methods are given for preserving gooseberries, currants, strawberries, cherries, raspberries, loganberries, and mulberries.

Stone fruits, C. Arnou (*Fruits a Noyaux. Paris: Author [1919], pp. 71+2, figs. 31*).—The fruits treated in this volume are apricots, peaches, prunes, pears, and quinces.

Preservation by sugar, C. Arnou (*Conservation par le Sucre. Paris: Author [1919], pp. 106+3, figs. 27*).—General methods of preserving fruit by the use of sugar are discussed.

Studies in the bacteriology of the cold pack canning method, R. Norminton (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 133–135*).—Essentially noted from another source (E. S. R., 43, p. 114).

The importance of infinitely small chemical substances in nutrition, G. Bertrand (*Bul. Soc. Sci. Hyg. Aliment., 8 (1920), No. 1, pp. 49–66*).—In this paper the author discusses the presence and possible significance in the human organism of metals and metalloids occurring in minute amounts, of certain amino acids, and of vitamins. Tables are given of collected data on the content of various food materials in arsenic, boron, iodin, copper, manganese, zinc, and fluorin. The theory, based upon the discovery of small amounts of manganese in the enzym laccase, is advanced that the above-mentioned elements may be essential in the structure of enzyms or necessary for enzymic action.

Note on the supposed identity of the water-soluble vitamin B and secretin, G. V. Anrep and J. C. Drummond (*Jour. Physiol., 54 (1921), No. 5–6, pp.*

349–352).—The authors are of the opinion that the results reported by Voegtlin and Myers (E. S. R., 44, p. 765) are too inconclusive to warrant the assumption of the probable identity of the antineuritic vitamin and secretin. To test the theory further, extracts from yeast which showed marked growth-promoting and antineuritic properties were compared with secretin as to stimulation of pancreatic juice in dogs. The vitamin extracts were found to have no specific action on pancreatic secretion. It is also reported that the pancreas of a cat, showing typical symptoms induced by a diet deficient in vitamin B, responded in a normal manner to secretin and that secretin has been extracted from the mucous membrane of the intestines of cats showing the so-called polyneuritic condition to a very marked extent.

The influence of heat and oxidation upon the nutritive and antiscorbutic properties of cow's milk, E. V. Anderson, R. A. Dutcher, C. H. Eckles, and J. W. Wilbur (*Science, n. ser., 53 (1921), No. 1375, p. 446*).—A brief note is given of a series of studies conducted at the Minnesota Experiment Station on the influence of heat upon the nutritive and antiscorbutic properties of milk.

Milk boiled in the open air or pasteurized in closed vessels was found to retain its antiscorbutic properties, while milk from the same source pasteurized by heating at 145° F. for 30 minutes with vigorous stirring lost its protective power against scurvy. Destruction of vitamin C also occurred when air was bubbled through the milk at 145° for 30 minutes and to a much more marked extent when oxygen or hydrogen peroxid was used, the destruction taking place with these reagents even at room temperature. Work still in progress indicates similar results in the case of orange juice. These results point to oxidation as a much more important factor than heat in destroying vitamin C.

Cooking and vitamins, E. M. Delf (*Sci. Prog. [London], 15 (1921), No. 60, pp. 601–612*).—This is a general discussion of the stability of vitamins toward heat, with particular application to the choice of methods of cooking vitamin-containing foods.

The influence of cod liver oil and butter fat on the retention of calcium and phosphorus, S. V. Telfer (*Jour. Physiol., 54 (1921), No. 5–6, pp. CV, CVI*).—In this preliminary communication the results are reported of observations on the calcium and phosphorus retention of an 8-months-old subject during three 5-day periods in which a constant intake of CaO and P_2O_5 was maintained with varying amounts of fat. The diets consisted, respectively, of cow's milk furnishing a daily intake of 21.6 gm. of fat, cow's milk supplemented with butter to furnish 43.2 gm. fat, and skim milk furnishing 7.2 gm. of fat with cod liver oil 21.6 gm. The average daily retention for the three successive periods was 0.34, 0.39, and 0.36 gm. of CaO and 0.31, 0.28, and 0.22 gm. of P_2O_5, respectively. These results are thought to afford no support to the claim of various workers that butter fat and cod liver oil in the diet specifically affect calcium retention.

Gastric analysis.—III, The examination of the abnormal gastric residuum, W. W. Lermann, M. E. Rehfuss, and P. B. Hawk (*Jour. Amer. Med. Assoc., 76 (1921), No. 20, pp. 1340–1342*).—Continuing the series of papers on gastric analysis previously noted (E. S. R., 45, p. 262), average data from the analyses of normal and abnormal gastric residuums representing interdigestive phases are presented and discussed. The standards of a normal residuum are given as follows: Volume from 20 to 100 cc. (average 50), total acidity, 10 to 50 (average 30); free acidity, 0 to 30 (average 18); pepsin index, 2.8 Mett; trypsin index, 9.1 average units; cryoscopic index, —0.47; and specific gravity, 1.0056, with no traces of food, blood, or pus, and only slight traces of gastric mucus. Pathological cases show in general an increase in volume and in total and free acidity, with a decrease in pepsin index and either a decrease or in-

crease in trypsin index. The significance of these variatons and of the presence of blood, pus, and mucus are discussed in detail.

Food deficiency diseases, H ARON (*Berlin. Klin. Wchnschr., 57 (1920), No. 33, pp. 773–777*).—A general discussion.

Diseases of infants due to prolonged feeding with excess of carbohydrates, C. E. BLOCH (*Brit. Med. Jour., No. 3139 (1921), pp. 293–295*).—Two pathological conditions brought about in infants by feeding with excess of carbohydrates are described under the terms "atrophia amylogenetica" and "dystrophia amylogenetica." In the author's experience, delicate and newly born infants are most susceptible to the atrophic form and the stronger and somewhat older ones to the dystrophic form, particularly if from time to time they have had a little milk or milk foods in addition to the carbohydrate diet. The symptoms, prognosis, and treatment of these conditions are described.

Changes in the adrenal bodies and the thyroid resulting from inanition, S. VINCENT and M. S. HOLLENBERG (*Jour. Physiol., 54 (1921), No. 5–6, pp. LXIX–LXXI*).—Chemical determinations of the adrenalin content of the adrenals of normal and inanition white rats are reported, the results of which confirm the authors' earlier observations that during the early stages of inanition there is an increase and during the later stages a decrease in the amount of adrenalin in the adrenals. The effects if inanition were found to be only temporary. Attention is called to the observation that the thyroids as well as the adrenals hypertrophy during inanition. Sections of the thyroids of inanition rats showed that the colloid substance normally contained in the thyroid vesicles was almost entirely lacking.

The relation of Bacillus botulinus to certain phases of home economics and agriculture, Z. NORTHRUP [WYANT] (*Mich. Acad. Sci. Ann. Rpt., 21 (1919), pp. 127–132*).—This is a discussion of the properties of *B. botulinus* and its toxin, based upon the literature and personal studies previously reported from other sources, with particular reference to possible dangers in connection with silage obtained from the strictly anaerobic portions of the silo and with canned products prepared by the usual methods of cooking and canning.

Treatment in botulism, V. BURKE, J. C. ELDER, and D. PISCHEL (*Arch. Int. Med., 27 (1921), No. 3, pp. 265–304*).—This is the report of a critical study of the literature on botulism and an extensive investigation of the causes and possible methods of treatment of the disease. The possibility of botulism resulting from the ingestion of toxin-free organisms is discussed in considerable detail, both from the literature and from the results of experimental inoculation of rabbits.

"The major evidence as we have presented it here favors the view that botulism in man very rarely, if ever, occurs following the ingestion of toxin-free organisms. The available evidence is too inconclusive to form the basis for any definite conclusions. Many of the facts presented can be explained in more than one way. Our own belief is that infection in human beings following the ingestion of toxin-free organisms never occurs. We are inclined to believe that the organism does produce toxin in the alimentary tract following the ingestion of preformed toxins and after paralysis has set in. Treatment of the digestive tract should be designed to neutralize and wash out the toxin and inhibit or destroy the organisms."

A practical point brought out in this connection is the necessity of prolonged boiling of suspected food. Experiments are reported which indicate that spoiled canned foods giving the appearance of boiling for 7 minutes and subjected to actual boiling for 4 minutes are not safe to eat, and also that spoiled canned foods exposed to a temperature of 80° C. for 1 hour may appear to be boiling

part of the time due to the evolution of gas. Vigorous boiling of all suspected foods for at least 30 minutes before tasting is recommended.

Experimental work on the extent to which antitoxin is effective in preventing death has shown that to be effective it must be given in excess before or very soon after the symptoms appear. The serum should be polyvalent, bacteriolytic as well as antitoxic, and should be injected intravenously. Tests of the effect of various foods on the appearance of the symptoms and on the death rate of botulism indicate that slight protection is afforded by substances such as oil or milk which retard the rate of absorption of the toxin. Certain substances including sodium hydroxid, potassium permanganate, and liquid soap appear to have a neutralizing action on the toxin. In conclusion recommendations are given for specific and general treatment of the disease.

The occurrence of pellagra in patients apparently receiving an ample diet, W. F. TANNER and G. L. ECHOLS (*Jour. Amer. Med. Assoc., 76 (1921), No. 20, pp. 1337, 1338*).—The authors confirm the observations of Roberts (E. S. R., 43, p. 862) that dietary eccentricities, principally against protein-containing foods, usually have existed prior to the onset of pellagra in subjects provided with an adequate diet. A case report is given in illustration.

Metabolism in pellegra: A study of the urine, M. X. SULLIVAN, R. E. STANTON, and P. R. DAWSON (*Arch. Int. Med., 27 (1921), No. 4, pp. 387–405*).—In this paper are reported the results of analyses of the urine of pellagra patients at the Pellagra Hospital of the U. S. Public Health Service at Spartanburg, S. C., during 1917. The tabulated data reported include the volume and specific gravity of the urine, and the total ammonia, uric acid, creatinin, urea, and undetermined nitrogen in daily output and in percentage of total nitrogen at varying periods from the time of admission to the hospital to the time of discharge. Two diets were used, one furnishing daily 2,646 calories and 13.01 gm. nitrogen representing 81 gm. protein, slightly more than half of which was of animal origin, and the other 2,971 calories and 16.604 gm. nitrogen representing 103.78 gm. protein of which 67 per cent was of animal origin. The first diet was generally used on admission, and the second after the health and appetite of the patients had somewhat improved.

The data obtained showed low excretion of P_2O_5, total nitrogen, and the ordinary urinary ingredients during the active stage of the disease with a heightened ratio of ammonia nitrogen and undetermined nitrogen, thus indicating a subnormal utilization of protein. After about a month on the curative diet the urinary constituents rose to approximately normal amounts, with readjustment to normal of the ratios of urea and ammonia to total nitrogen.

Sulphocyanate content of the saliva and urine in pellagra, M. X. SULLIVAN and P. R. DAWSON (*Jour. Biol. Chem., 45 (1921), No. 3, pp. 473–488*).—Supplementing earlier determinations of the thiocyanate content of the saliva of pellagra patients (E. S. R., 41, p. 469), a comparative study was made in 1919 of the thiocyanate content of the saliva and urine of pellagra patients at the U. S. Pellagra Hospital, Spartanburg, S. C., on admission and discharge from the hospital.

As a rule the thiocyanate content of both saliva and urine was greater on discharge than on admission. The increase is thought to be associated with the betterment of the general condition of the patient, with better assimilation, a higher protein metabolism, and presumably a greater detoxifying power of the system as a whole.

Clinical investigation of xerophthalmia and dystrophy in infants and young children (xerophthalmia et dystrophia alipogenetica), C. E. BLOCH (*Jour. Hyg. [Cambridge], 19 (1921), No. 3, pp. 283–304, pls. 3, figs. 5*).—This paper is an abridged English translation by Thaysen and E. E. Atkin of two

papers by the author on xerophthalmia in infants and young children published in Danish in 1917 and 1918, together with a brief account of the author's experience with the same disease in 1918 and 1919. The publication in English of the reports of these studies was undertaken by the British Committee on Accessory Factors on account of their unusual interest when considered in conjunction with the experimental production of the disease in rats by a deficient diet.

The material reported upon in the first paper covered 40 cases from 1912 to 1916 and 23 cases from 1917 to 1918, all among children treated in the children's section of the State hospital at Copenhagen. Of the first 40 cases 5 showed xerosis alone, 28 keratomalacia of both eyes, and 7 of one eye only. In all these cases the eye lesion was only part of the disease. Three distinct conditions of malnutrition were noted and classified as carbohydrate atrophy, carbohydrate dystrophy, and a condition designated by the author as "dystrophia alipogenetica," all three of which were combined with xerophthalmia. The last two types are described in detail.

The type described under the name of carbohydrate dystrophy was noted in infants under a year old who had been for a long time on a diet consisting mainly of carbohydrates. The principal symptoms in addition to xerophthalmia were edema and hypertonicity of muscle, all of which disappeared under treatment with whole milk and cod liver oil. The children showing the third type, the principal symptoms of which were inhibited growth and loss of weight followed by the eye condition, had been on a diet of centrifuged milk, milk puddings made with this separated milk, and a limited amount of potatoes and bread. The 23 cases reported in 1917 were mostly of this third type.

Among the points brought out in the discussion of the causes of xerophthalmia are that, in addition to the absence of the fat-soluble vitamin there are two factors of considerable importance in its development—the influence of season and of other infections on the appearance and course of the disease. A chart giving the seasonal periods of growth and the seasonal incidence of xerophthalmia shows that the cases of xerophthalmia all occurred during the seasons of greatest growth. "As xerophthalmia is caused by the absence of bodies essential for growth, it is clear that the disease will predominate during that part of the year when the organism consumes the largest quantities of lipoid bodies, for its growth, i. e. during the maximum period for growth." The second is illustrated by the fact that the earlier cases of xerophthalmia were discovered in the final stages of prolonged disease. The author suggests as the explanation "that the specific lipoid bodies (vitamin A) are necessary for the formation of antibodies against infection and are continually used up in the process as in the case of growth."

The observations on xerophthalmia in Denmark during 1918 and 1919 afford a striking illustration of the relationship between vitamin A and xerophthalmia. During 1918 the disease almost disappeared, coincident with a radical change in the diet. Owing to the blockade the manufacture of margarin ceased and butter under State control was universally used in its place.

The article is illustrated with photographs showing the three types of malnutrition noted with varying degrees of xerophthalmia.

Xerophthalmia in fowls fed on polished rice and its clinical importance, L. E. Guerrero and I. Concepcion (*Philippine Jour. Sci., 17 (1920), No. 1, pp. 99–103*).—The authors call attention to the fact that they have observed xerophthalmia in experimental fowls on a polished rice diet. Since fowls live in apparently perfect condition for a long time on unpolished rice, the inference is made that the latter contains vitamin A. A brief review is given of clinical reports of xerophthalmia in Japan, Denmark, etc.

Laboratory manual of the technique of basal metabolic rate determinations, W. M. BOOTHBY and I. SANDIFORD (*Philadelphia and London: W. B. Saunders Co., 1920, pp. 117, pls. 4, figs. 14*).—This manual, which has been prepared as a guide to the use of basal metabolic rate determinations as a diagnostic procedure (E. S. R., 45, p. 66), contains sections on the general principles of the method, details of the technique, and calculations of results. An appendix contains tables which have been compiled to simplify the regular methods of calculation and specimen charts from the Mayo clinic illustrating the observations involved, with the resulting calculations. An extensive bibliography, photographs of the apparatus, and various tables are included.

The physiological cost of muscular work measured by the discharge of carbon dioxid, A. D. WALLER and G. DE DECKER (*Roy. Soc. [London], Proc., Ser. B, 91 (1920), Nos. 637, pp. 166–185, figs. 3; B 639, pp. 229–248, figs. 6*).—Two papers are presented.

I. *The energy output of dock laborers during "heavy work."*—This reports in detail the results obtained in the investigation of the energy output of dock laborers, a few data from which have been previously noted (E. S. R., 43, p. 463). The average results in net calories per square meter per hour were 117±2.6 for one subject for 3 days on a time scale of pay, and 128±8.7 for another on 6 days of part time, piece, mixed, and time work.

II. *The energy output of laborers on cold storage work.*—A similar study to the above is reported for cold storage workers, the work consisting principally in moving from storage van to storage chambers (temperature 16° F.) meat, poultry, cheese, etc. A short series of studies with three subjects at the Surrey Docks where the work was not continuous gave results yielding an average of 77±9.2 net calories per square meter per hour. Longer periods of observation at storage warehouses connected with a large market gave a net cost of 123±9.8 calories as the average of six determinations of two subjects on day work, while the average for a similar number on night work was 119±10.7.

The physiological cost of printer's work measured by CO_2 and expressed in calories, A. D. WALLER and G. DE DECKER (*Jour. Physiol., 53 (1920), No. 6, pp. CIV, CV*).—Tables are given summarizing results obtained in observations of the physiological cost of printer's work. The average gross cost of the day's work (9 hours) was 1,125 calories for men (means of 12 days' observation) and 855 calories for women (mean of 5 days). Expressed as calories per square meter per hour the results were substantially the same for men and women, 35.4±1.67 for the former and 35.9±2.65 for the latter.

The physiological cost of work in various departments of *The Times* Printing House, A. D. WALLER and G. DE DECKER (*Jour. Physiol., 53 (1920), No. 6, pp. CV–CVII, fig. 1*).—A summary is given of the results obtained in a series of 65 observations of the CO_2 output of operators in six departments of a printing establishment during normal night work. From these have been calculated the gross energy discharge per man during the night work of 7½ hours, the mean energy output per hour per square meter of body surface and net values obtained by subtracting from the gross cost per hour (1) the calorific value of the CO_2 observed at rest immediately before work and (2) an average basal value of 2 cc. CO_2 per second per square meter or 40 calories per hour per square meter, the body surface being calculated from body weight and height by Dubois' formula.

The total gross cost per night for the different groups was as follows: Composers 1,214, casters 1,466, imposers 1,642, proof readers 429, founders 1,129, and machinists 1,081 calories. All of these groups worked 7½ hours with the exception of the founders and machinists, who worked 6 and 7 hours, respectively. The average net values in calories per hour per square meter were as follows:

Composers 47±7, casters 77±6, imposers 82±4, readers 0, founders 70±4, and machinists 53±3. Attention is called to the remarkably low value obtained in the proof reading room, the mean value of 34.6 calories per hour per square meter being practically the same as the observed resting value 34.4. "This corresponds with the fact that the work of proof reading is wholly cerebral during almost complete muscular quiescence for an unbroken period of 7½ hours. Our figures (which it would be desirable to control by further and closer observations) show clearly that the CO_2 discharge can not be utilized as a guide to the food requirements of all classes of workers; it indicates the cost of muscular work alone. We do not at present possess any certain knowledge of the cost of cerebral work. The case of the proof reader affords the clearest possible evidence that such work does not involve any sensible oxidation of carbon."

Energy expenditure in minor duties, E. P. CATHCART and F. J. TRAFFORD (*Jour. Physiol., 53 (1920), No. 6, p. XCIX*).—Data on the energy expenditure in certain minor duties as determined by indirect calorimetry on a subject 4 hours after the last meal, breakfast, are reported. The calories per square meter per minute expended were as follows: For brushing boots and clothes and polishing buttons, 1.43; washing hands, face, and neck, and brushing hair, 1.52; window cleaning, 1.81; and scrubbing floor, 2.11 calories.

The heat-regulating mechanism of the body, H. G. BARBOUR (*Physiol. Rev., 1 (1921), No. 2, pp. 295–326, fig. 1*).—This comprehensive literature review includes a bibliography of 161 titles.

ANIMAL PRODUCTION.

On the numerical expression of the degree of inbreeding and relationship in a pedigree, T. ELLINGER (*Amer. Nat., 54 (1920), No. 635, pp. 540–545, fig. 1*).—The author proposes (1) that the coefficient of relationship between sire and dam for the nth generation of a pedigree, K_n, have a value half the size of that suggested by Pearl (E. S. R., 38, p. 65), i. e., that the maximum coefficient for any generation be 50; (2) that a total relationship coefficient for the entire pedigree, K_{Tn}, be adopted and taken equal to $2/n$ times the sum of the K's from generation 1 to generation n; and (3) that the proportions of the inbreeding in the pedigree due to the relationship between the parents be expressed as a total relationship inbreeding index, KZ_{Tn}, equal to 100 times the ratio of the sum of the K's to the sum of the Z's (Pearl's inbreeding coefficients) from generation 1 to generation n. Although the Z_n, K_n, and KZ_n, functions have a meaning only when n is an integer, the author follows Pearl in speaking of the corresponding total or pedigree functions as integrals and areas.

Composition of silage, A. J. PATTEN (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, p. 142*).—The following analyses of silage are reported:

Chemical composition of four kinds of silage.

Kind of silage.	No. of samples.	Moisture.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Corn	12	72.35	2.52	0.82	6.20	16.93	1.13
Corn stover	2	77.84	1.55	.40	7.55	11.61	1.06
Sunflower	2	76.35	2.66	.84	7.14	11.16	1.85
Sugar beet tops (pit silo)	1	76.12	3.38	.49	2.24	8.06	9.71

Effects of some Cucurbita seeds on animal metabolism, B. MASUROVSKY (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 523–539*).—The author, work-

ing at the New Jersey Experiment Stations, fed 18 30-lb. pigs for two months. Six received corn, middlings, and tankage throughout, forming a check lot. The others, in addition to these feeds, were given pumpkin pulp or pulp and seed during the early part of the experiment, and some toward the end were given seed secured from a factory where pumpkins and squash were canned.

Owing to the variation in the rate of growth of the individual pigs, the author is unwilling to attribute to the method of feeding the slight differences in health and growth between the control and experimental groups, and concludes that the cucurbit seeds were in no sense injurious, but on the contrary formed a useful and economical feed. The weights and feed consumption at weekly intervals of the individual pigs are tabulated and also the proximate composition of each of the feeds offered.

Experimenting with himself, the author ate cannery seeds, such as were used in the pig experiments, in connection with his regular meals. The seed coats were removed, and the seeds were browned and sterilized in an oven before use. The ingestion of these seeds caused a reduction in the volume of urine and an increase in the acidity. The reduced volume was associated with decreased amounts of total nitrogen and creatinin. It is stated that stockmen believe that the consumption of pumpkin and squash seeds increases the kidney activity.

Comparative investigations of the natural and artificial digestion of crude fiber, W. THOMANN (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gsndhtsamt., 11 (1920), No. 5–6, pp. 227–236*).—In this address the author presents data on the chemical composition and digestibility of the crude fiber in hydrolized wheat straw, and discusses the possibility of using indirect methods of estimating the capacity of ruminants to digest crude fiber.

The straw was hydrolized by the Dahlem process (cooking without pressure for five hours in 1.25 per cent sodium hydroxid). Untreated straw and the hydrolized material after washing with water or neutralization with whey were each fed to sheep in digestion trials and also digested artificially in ammoniacal cupric oxid according to the method of Mach (E. S. R., 43, p. 315). These results are assembled in the following table:

Composition and digestibility of the crude fiber in hydrolized wheat straw.

Treatment of straw.	Crude fiber content.	Composition of crude fiber.			Digested by sheep.			Crude fiber soluble in Cu $(NH_3)_4(OH)_2$.
		Pure cellulose.	Pentosans.	Lignin.	Crude fiber.	Pure cellulose.	Pentosans.	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Untreated	41.16	83.53	9.97	9.94	47.49	53.35	44.22	56.23
Hydrolyzed; neutralized with whey	47.91	71.43	14.25	15.05	70.34	76.39	81.84	68.80
Hydrolyzed; washed with water	57.24	73.79	13.48	14.61	75.31	81.64	87.25	75.35

All the lignin was recovered in the feces. The method of artificial digestion is considered a good indication of the natural digestibility of crude fiber, particularly when the crude fiber content is high. This conclusion is confirmed by the results of artificial digestion of other feeding stuffs. Unpublished digestion experiments by K. Meier are cited in which rabbits were fed bran, oats, corn, potato meal, barley, reed meal, alfalfa hay, silage, etc. In the case of the grains the ratio of the observed digestion coefficients for the crude fiber to the artificial coefficients averages 0.72. In the case of the roughages this ratio was 0.49. The ratio between the crude fiber coefficients of rabbits and cattle was 0.78 in the case of grain and 0.48 in the case of crude fiber.

In a comparison of methods for determining crude fiber, it was found that determinations by the Weender method were more irregular than those by the Cross-Bevan method, particularly with hydrolized straw. The latter method gives higher values owing to the inclusion of considerable quantities of ash and pentosans (but not lignin), while the procedure in the Weender method destroys some of the pure cellulose.

Straw treated by the Beckmann process and its digestibility, H. WAGNER and G. SCHÖLER (*Fühling's Landw. Ztg., 68 (1919), No. 11–12, pp. 228–234*).—The authors report digestion experiments with sheep fed straw hydrolyzed by the Beckmann process (treatment with sodium hydroxid at ordinary temperatures).

When the hydrolyzed straw was fed moist, 64.6 per cent of the organic matter, 78.1 per cent of the crude fiber, and 55.5 per cent of the nitrogen-free extract was digested. With dried straw the corresponding figures were 65.9 82.5, and 44.2, respectively. When blood meal was added as a protein supplement there was an apparent depression in protein digestion if Stutzer's correction for nitrogen excreted in the intestine was used.

The digestibility of straw after treatment with soda, W. GODDEN (*Jour. Agr. Sci. [England], 10 (1920), No. 4, pp. 437–456*).—This is a report of digestion and nitrogen balance trials with sheep conducted at the University of Leeds to determine the value of oat straw hydrolyzed by a modification of the Lehmann process in which the chopped straw is soaked over night in 1.5 per cent sodium hydroxid solution and then steamed for 1 hour in a closed tank. The feeds offered in the successive 14-day periods were as follows: (1) Untreated oat straw and commercial casein, (2) "crude concentrate" straw and linseed cake, (3) untreated straw and linseed cake, and (4) "washed concentrate" straw and linseed cake. The crude concentrate consisted of the dried hydrolyzed material and the washed concentrate of the same steeped in water until neutral to litmus (about 4 days). The coefficients of digestibility of the untreated straw were determined from the results of period 1 by assuming that the casein was all digested except the pepsin-insoluble fraction (2.16 per cent) of the purified protein. These coefficients in turn were used in connection with the data of period 3 to compute the digestibility of the linseed cake fed in periods 2 and 4. The following table summarizes the data on the composition and digestibility of the three kinds of straw:

Composition and digestibility of hydrolyzed oat straw (concentrate straw) and ordinary oat straw.

Description of straw.	Moisture in air dry material.	Composition (dry basis).					Digestibility (sheep).			
		Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Organic matter.	Ether extract.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Untreated staw	12.75	2.34	2.02	46.51	43.83	5.30	47.3	43.6	60.1	39.6
Crude concentrate	75.61	1.27	1.56	59.41	29.27	8.49	73.7	24.7	87.4	62.9
Wasted concentrate	47.73	1.20	1.45	66.45	26.90	4.00	72.2	29.9	83.3	63.8

The digestion of protein from the straw was negative in all cases. The nitrogen stored averaged 4.3 gm. per day during crude concentrate feeding, 3.6 gm. during the washed concentrate feeding, and only 0.56 gm. (despite a slightly higher intake) during the feeding of untreated straw in period 3. The feeding of the hydrolyzed straw, particularly the crude concentrate, in-

creased the pentose content of the urine, but was without effect on the condition of the sheep.

Digestibility of peat moss after treatment with acid, W. GODDEN (*Jour. Agr. Sci. [England], 10 (1920), No. 4, pp. 457–459*).—The sheep used in the experiments noted above were continued through a fifth period during which peat moss, oat straw, and linseed cake were fed. The peat moss was a proprietary product made by subjecting the finely shredded moss to the action of hydrochloric acid gas. The treated peat moss had the following percentage composition: Moisture 22.57, crude protein 4.87, ether extract 3.44, crude fiber 20.64, nitrogen-free extract 42.48. The following were the average coefficients of digestibility of the moss: Organic matter 20.8, ether extract 32.7, crude fiber 37.6, nitrogen-free extract 19.2. None of the protein was digested.

Fourth and fifth annual reports for the years 1919–1920 by the Oklahoma State Live Stock Registry Board (*Oklahoma Sta. Circ. 47 (1921), pp. 155, figs. 4*).—This report consists of lists of names, registry numbers, ownership, etc., of stallions and jacks licensed in 1919 and 1920, classified by breeds, and differs from the previous report (E. S. R., 42, p. 561) in not including any general articles.

Steer feeding experiments, 1920–21, C. W. HICKMAN, E. F. RINEHART, and A. W. JOHNSON (*Idaho Sta. Circ. 18 (1921), pp. 4*).—A 100-day feeding test with 118 steers divided into 10 lots is reported, partly in continuation of the previous year's comparison of methods of preparing alfalfa (E. S. R., 44,, p. 671) and partly to study the effects of varying the silage and grain rations.

Alfalfa was consumed ad libitum by all lots. The lot fed long alfalfa alone made a daily gain of 2.01 lbs. per head, the lot fed cut alfalfa gained 1.71 lbs., the lot fed alfalfa meal gained 1.52 lbs., and the lot fed alfalfa meal mixed with 20 per cent beet molasses gained 1.92 lbs. The amounts of alfalfa consumed per head per day by the steers in these 4 lots were, respectively, 36, 31, 33, and 34 lbs.

The 6 other lots were used in a comparison of two silage rations (averaging 14.16 and 24.25 lbs., respectively) and two barley rations (5.65 and 8.55 lbs., respectively). The average daily gains were as follows in the several combinations: No grain, heavy silage, 2.31 lbs.; no grain, light silage, 1.72 lbs.; heavy barley, light silage, 2.3 lbs.; light barley, heavy silage, 2.46 lbs,; light barley, no silage, 2.04 lbs.; and heavy barley, no silage, 2.21 lbs.

Lamb feeding experiments, 1920–21, C. W. HICKMAN, E. F. RINEHART, and A. W. JOHNSON (*Idaho Sta. Circ. 19 (1921), pp. 4*).—Results are reported of a 100-day feeding experiment involving 465 70-lb. lambs divided into seven lots. All received a ration of 1 lb. of barley and long, chopped, or ground alfalfa hay. Lambs in three of the lots received also a ration of 0.5 lb. of corn silage.

Whether fed with silage or without, the long alfalfa produced greater gains than the alfalfa meal, which in turn proved superior to the cut alfalfa. The addition of the silage increased the gains of animals fed cut alfalfa or alfalfa meal, but had no substantial effect on the gains of the lambs fed long alfalfa. The lot fed alfalfa meal mixed with 20 per cent of beet molasses made more rapid gains than any other lot.

Supplements to corn for fattening swine, W. L. ROBISON (*Ohio Sta. Bul. 349 (1921), pp. 131–183, figs. 37*).—The author reports 11 feeding experiments with pigs carried out in the years 1916 to 1920. Some of the experiments, particularly those dealing with the use of soy beans and corn germ meal as supplements to corn, have been noted from preliminary reports (E. S. R., 43, p. 377; 44, p. 177),

In two of the experiments the pigs had access to rape pasture; the others were dry-lot experiments. Particular attention was devoted to protein supplements of plant origin because of the inadequate supply of animal by-products. The following table gives the author's averages of several experiments which permitted a direct comparison between a plant protein source and tankage, as fed both in a dry lot and with forage:

Comparisons between plant materials and tankage as protein supplements to corn in feeding pigs.

Place of feeding.	Supplement.	Number of tests.	Initial weight per head.	Final weight per head.	Daily gain per head.	Consumed per pound of gain.			Relative gain.	Relative consumption per unit gain.
						Corn.	Supplement.	Total.		
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Dry lot.	Linseed meal	4	59.5	179.8	1.15	3.75	0.48	4.23	83.3	111.7
Do.	Tankage	4	60.2	182.0	1.38	3.50	.28	3.79	100.0	100.0
Pasture.	Linseed meal	2	63.4	212.9	1.42	3.26	.41	3.67	99.3	101.2
Do.	Tankage	2	63.0	213.5	1.43	3.44	.18	3.62	100.0	100.0
Dry lot.	Ground soy beans	2	73.9	170.2	1.23	3.94	.30	4.24	74.9	116.9
Do.	Tankage	2	73.6	176.8	1.64	3.33	.30	3.63	100.0	100.0
Pasture.	Ground soy beans	2	63.4	206.3	1.32	3.40	.45	3.85	93.9	106.3
Do.	Tankage	2	63.0	205.3	1.41	3.44	.18	3.62	100.0	100.0
Dry lot.	Soy bean oil meal	3	67.6	187.9	1.27	3.74	.28	4.02	84.9	106.3
Do.	Tankage	3	67.4	189.1	1.50	3.47	.31	3.78	100.0	100.0
Pasture.	Soy bean oil meal	2	87.9	222.1	1.58	3.54	.32	3.86	105.8	98.4
Do.	Tankage	2	88.4	221.1	1.50	3.69	.24	3.93	100.0	100.0
Dry lot.	Buckwheat middlings.	2	55.7	140.9	.87	4.07	.50	4.57	72.5	118.8
Do.	Tankage	2	56.1	140.3	1.20	3.51	.34	3.85	100.0	100.0
Pasture.	Buckwheat middlings.	1	67.5	226.0	1.51	3.28	.55	3.82	100.7	102.3
Do.	Tankage	1	66.6	224.0	1.50	3.55	.19	3.74	100.0	100.0
Dry lot.	Corn germ meal	1	56.6	156.3	.89	2.64	1.32	3.96	69.4	108.5
Do.	Tankage	1	57.0	155.8	1.28	3.37	.28	3.65	100.0	100.0
Pasture.	Corn germ meal	1	60.0	200.7	1.26	2.83	.94	3.77	91.1	107.3
Do.	Tankage	1	59.7	204.8	1.38	3.34	.18	3.52	100.0	100.0

Attention is called to the fact that some of the plant materials, when fed to pigs on pasture, proved to be substantially equal to tankage.

In another experiment lasting 7 weeks the feeding of a mixture of corn and linseed meal (6:1) produced a gain of 2.14 lbs. per head daily, or 1 lb. of gain for each 3.96 lbs. of feed consumed. The feeding of the two materials separately by the free choice system resulted in a gain of only 1.7 lbs. per day, and 4.3 lbs. of feed were required for a pound of gain. In the latter case the ratio of corn to supplement was 25.8:1. The use of mixtures is recommended when the supplement is not palatable. The addition of ground limestone and ground rock phosphate to the ration of lots fed linseed meal and soy bean meal caused marked improvement in the gain in the one experiment in which it was tried. For other results in feeding mineral supplements to swine see Bulletin 347 (E. S. R., 45, p. 370).

Several other plant materials and a number of animal by-products were also used in the experiments. The results of these experiments, not hitherto noted, are for the most part included in the table following.

Comparisons of protein supplements to corn for feeding pigs in the dry lot.

Experiment.	Lot.	Supplements compared.	Ratio corn to supplement.	Length of test.	Initial weight per head.	Daily gain per head.	Ration per 100 lbs. weight.	Consumed per pound of gain.		
								Corn.	Supplement.	Total.
				Weeks.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
3	1	Meat meal	13.1:1	14	54.4	1.31	4.58	3.85	0.29	4.14
	5	Tankage	14.6:1	14	53.5	1.55	4.71	3.68	.25	3.93
4	1	....do	10.4:1	15	55.1	1.30	3.97	3.59	.35	3.93
	2	Meat meal	9.3:1	15	55.0	1.05	3.84	3.65	.39	4.05
	9	Skim milk	1:2.2	15	55.3	1.38	.....	3.27	7.25	.....
5	1	Tankage	12:1	16	57.0	1.45	3.90	3.44	.29	3.72
	2	Fish meal	9:1	16	57.2	1.62	3.86	3.17	.35	3.52
	4	Coconut meal	2.5:1	16	56.1	.98	3.86	3.12	1.25	4.37
	6	Peanut meal	6:1	16	56.8	1.33	3.85	3.26	.54	3.81
	7	Linseed meal	5.5:1	16	57.3	1.34	3.82	3.19	.58	3.76
6	1	Tankage	12:1	12	81.8	1.77	4.28	3.48	.29	3.77
	2	Fish meal	13.2:1	12	81.8	1.79	4.09	3.34	.25	3.59
	3	Skim milk	1:2	12	81.8	1.45	.....	3.09	6.17	.....
	4	Linseed meal	6:1	12	81.7	1.16	3.85	3.74	.62	4.36
	5	Linseed meal and tankage (3:1)	7.5:1	12	81.8	1.65	4.27	3.45	.46	3.91
	7	Dried milk albumen	9:1	12	80.9	1.60	3.68	3.06	.34	3.41
7	1	Tankage	14:1	16	42.0	.89	.....	3.78	.27	4.06
	2	Linseed meal	6:1	16	41.5	.78	.....	3.91	.65	4.56
	3	Linseed meal and tankage (3:1)	7:1	16	41.4	.96	.....	3.78	.54	4.31

The product called milk albumen was dried skim milk from which the milk sugar had been removed. The meat meal differed from tankage in consisting of muscular and fatty tissue alone. The fish meal was made from menhaden from which the oil had been extracted and was supplied by the Bureau of Animal Industry, U. S. Department of Agriculture.

Legume hay was fed in three experiments. In experiment 4 the feeding of alfalfa improved the gain and economy of gain from a corn and linseed meal ration. In experiment 5 clover hay increased the rate of gain with a corn germ meal ration, but no concentrates were saved. With a linseed meal ration, there was no advantage in either the rate or economy of gains. In experiment 8 a ration of corn and clover hay proved superior to corn alone, but inferior to corn and tankage. The pigs were not able to consume enough of the hay to balance the ration. None of the pigs fed legume hay showed any tendency toward paralysis, a characteristic of some of the pigs fed in the dry lot without roughage, particularly those given meat meal or buckwheat middlings.

Swine production, M. F. GRIMES (*Pennsylvania Sta. Bul. 168 (1921), pp. 16, figs. 3*).—Three sets of experiments are reported dealing, respectively, with fattening rations, forage crops, and winter rations for brood sows. The results of the experiments with sows have already been noted (E. S. R., 43, p. 572).

The fattening experiments involved comparisons of protein supplements and a study of the value of the pasture, and were conducted in two successive and a study of thte value of pasture, and were conducted in two successive in the table following.

Two comparisons of protein supplements to corn for fattening swine.

Lot No.	Supplements compared.	Pasture.	Ratio corn to supplement.	1918 test (71 days).				1919 test (84 days).			
				Initial weight per pig.	Daily gain per pig.	Feed per pound of gain.	Final weight per pig.	Initial weight per pig.	Daily gain per pig.	Feed per pound of gain.	Final weight per pig.
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
5	Tankage.....	None .	10:1	80.9	1.33	3.98	173.7	66.1	1.13	3.84	161.0
1	.....do.....	Rape .	12:1	83.0	1.72	3.34	203.6	65.0	1.41	3.42	183.7
2	Fishmeal.....	...do..	11.5:1	84.8	1.82	3.31	212.2	65.3	1.52	3.25	193.0
3	Linseed meal.	...do..	6:1	82.8	1.51	3.63	188.5	65.6	1.50	3.63	191.5
4	Semisolid buttermilk.....	...do..	3.5:1	82.8	1.46	4.11	184.2	65.0	1.49	3.66	191.6

The experiments with the forage crops were also made in two years, the summers of 1919 and 1920. In the first year the pasture period lasted 35 days, the pigs averaged about 46 lbs. in weight, and there were 25 pigs to an acre. In the second year the initial weight of the pigs was about 40 lbs., 23 pigs were placed on each acre plat, and the pasture period lasted 42 days. In each year the gain on the rape plat was greater than the gains on the plats seeded to either rape and oats or rape, oats and peas, and the grain required for unit gain was also less in each case. The pigs on rape, oats and peas consumed less grain per unit gain than those on rape and oats. The desirability of a good stand of rape in the rape and oat combination is emphasized.

Finishing the pullets, W. P. Thorp, jr. (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 11, pp. 4, fig. 1*).—Suggestions are given for feeding pullets during the summer to secure proper growth and to control the onset of egg production.

DAIRY FARMING—DAIRYING.

Report of progress on animal husbandry investigations in 1920, J. W. Gowen (*Maine Sta. Bul. 299 (1921), pp. 85–120, figs. 7*).—This is the customary report of the biologist of the station (E. S. R., 43, p. 174), and contains abstracts of the paper noted below and of two papers on inheritance of milk production previously noted (E. S. R., 45, p. 475) and preliminary reports of various investigations, mostly connected with the physiology of milk production.

The 7-day test, as used with Holstein-Friesian cows, was studied with reference to its correlation with the 365-day test. It is concluded that the 7-day test is of material value in determining the worth of a cow, although the year test is a more accurate basis for predicting the yields in subsequent lactations.

The results of previously noted studies (E. S. R., 44, p. 675) of the influence of age on milk yield and butter-fat percentage, as shown by the advanced registry records of Holstein, Jersey, and Guernsey breeds, are used as a basis of discussion of advanced registry requirements. It is shown that the younger ages tend to be discriminated against in admission to advanced registry, and that the maximum fat yield usually occurs at the age of about 8 years, although admission requirements do not increase after the fifth year.

The data on twinning noted from the 1917 report (E. S. R., 40, p. 872) are supplemented by a study of twin births recorded in the Holstein, Jersey, Guernsey, Shorthorn, and Angus herd books, with particular reference to the age of parents at the time the twins were born. It was found that the sires tended to be younger than the sires of calves born singly, although the reverse tendency was manifested by the dams.

A study has been completed of Holstein-Friesian sires with regard to the performance of their progeny, similar to the studies undertaken with the Guernsey and Jersey breeds (E. S. R., 40, p. 872; 43, p. 175). It was found that a sire of daughters whose production exceeded that of their dams was apt to be somewhat more closely inbred than the average sire, although in some of the comparisons the difference is not very significant. The results indicate at least that inbreeding, as normally carried on within the Holstein-Friesian breed, is without detrimental effect upon production.

A compilation is included of the butter-fat percentage and percentage of total solids in the milk of various breeds. This is intended to be used as a basis for determining what effect standardization to a definite fat percentage would have on the percentage of solids-not-fat.

Studies on conformation in relation to milk-producing capacity in cattle.—II, The personal equation of the cattle judge, J. W. Gowen (*Jour. Dairy Sci., 4 (1921), No. 5, pp. 359–374*).—The author amplifies his previous study (E. S. R., 44, p. 178) of the judges' scores of Jersey cows admitted to the Register of Merit (in the early days when this scoring was customary) by a study of the ability of the individual judges to estimate the productivity of a cow by means of the score card. There were 19 judges who scored 25 or more cows. The highest coefficient of correlation between score and milk yield was 0.614, and the average was 0.246. In the case of two of the judges the correlation was negative. Nine of the judges are considered able to discriminate between high and low producing cows on the basis of conformation. Various individual differences between the judges in average scores and variability in scoring are pointed out.

Wintering dairy heifers, R. E. Hunt (*Virginia Sta. Bul. 225 (1921), pp. 15, figs. 5*).—Continuing the work reported in Bulletin 219 (E. S. R., 39, p. 783), the author reports experiments in feeding dairy heifers during three additional winters. In 1920–21 four heifers formed a lot, while in the two previous years there were five heifers to a lot. Each heifer received a daily allowance of 30 lbs. of silage and a protein supplement.

During the first winter, supplementing the corn silage with a ration of 3.25 lbs. of coconut meal produced substantially the same gain (1.3 lbs. per head daily) as 2.5 lbs. of cottonseed meal. A ration of 4 lbs. of velvet bean meal fed with the corn silage produced a daily gain of only 0.84 lb.

In the other two winters stover silage mixed with one-tenth its weight of feeding molasses was compared with corn silage. The addition of 2.5 lbs. of cottonseed meal to the stover ration did not produce quite the gains secured from such an addition to corn silage, but the gains are considered satisfactory. In the second year neither peanut oil meal (2.5 lbs.) nor velvet bean meal (4 lbs.) fed with the stover silage produced the gain secured with cottonseed meal. The failure of velvet bean meal is attributed largely to its lack of palatability. In the third year 2.5 lbs. of gluten meal fed with the stover silage mixture produced almost the same gain as 2.5 lbs. of cottonseed meal. To judge from the results with one lot in the third year, 2 lbs. of corn added to 30 lbs. of stover silage is by no means as satisfactory as 3 lbs. of molasses.

Dairy farming, J. B. Fitch (*Kansas Sta. Circ. 90 (1921), pp. 32, figs. 13*).—This is a revision of Circular 45 (E. S. R., 32, p. 870). In addition to many minor changes, new production records are cited, and a map is included showing the distribution of dairy cattle and dairy plants in Kansas.

Standards for judging the bacterial condition of market milk, L. H. Cooledge (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, p. 144*).—The author states that the rate of change in the H-ion concentration of milk affords a good basis for judging the keeping quality, and points out that bacterial counts give

little indication of the rate of souring to be expected when a large number of inert organisms are present. See also the papers of Cooledge and Wyant (E. S. R., 43, p. 615).

Hot air sterilization of dairy utensils, S. H. Ayers and C. S. Mudge (*Jour. Dairy Sci., 4 (1921), No. 2, pp. 79–90; also in Creamery and Milk Plant Mo., 10 (1921), No. 5, pp. 43–46*).—The authors report laboratory experiments conducted in the Dairy Division of the U. S. Department of Agriculture for the purpose of working out a technique for a practicable hot air treatment of dairy utensils sufficiently severe to kill all bacteria likely to be present except the spore-forming types. Adequate sterilization in this limited sense occurred when carelessly washed cans were heated to 230° F. and held there 30 minutes. Raising the temperature from 112° (washing temperature) to 248° in 4 minutes and then holding for 2 minutes seemed also to be a satisfactory process, and is suggested as a possible scheme in milk plants where time is important and the cleansing process must be carried on more or less continuously.

Manufacture of cows'-milk Roquefort cheese, K. J. Matheson (*U. S. Dept. Agr. Bul. 970 (1921), pp. 28, figs. 11*).—Detailed directions are given for the manufacture of cheese of the Roquefort type from cows' milk, based upon the experience of the Grove City, Pa., factory of the Dairy Division. Particular attention is devoted to the care and attention necessary in ripening and curing the cheese, and cheese factories are cautioned against attempting to make cows'-milk Roquefort on a commercial scale without having the facilities for carrying out these operations properly.

The influence of reaction on color changes in tyrosin solutions, E. C. V. Venn (*Biochem. Jour., 14 (1920), No. 2, pp. 99–102, fig. 1*).—Certain bacteria isolated from discolored Stilton cheese were found capable of producing color in suspensions of various amino acids. With tyrosin, which is present in considerable quantities in the ripe cheese, the color production occurred within a range of pH values varying from 3.23 to 9.7.

On the presence of amylase in milk and cheese, M. Sato (*Biochem. Jour., 14 (1920), No. 2, pp. 120–130*).—The author reports the presence of a starch-digesting enzym in two samples of Cheddar cheese examined, and confirms the observations of other investigators that this enzym is present in raw milk.

The industries associated with the dairy, A. Rolet (*Les Industries Annexes de la Laiterie. Paris: J. B. Baillière & Sons, 1920, new ed., rev. and enl., pp. 368, figs. 80*).—This is a treatise on the manufacture of condensed milk, milk powder, casein, skim milk cheese, fermented milks, skim milk, whey, and buttermilk, the industrial uses of these products, and their utilization in feeding live stock. A discussion of the disposal of waste products is appended.

VETERINARY MEDICINE.

Report of the twenty-fourth annual meeting of the United States Live Stock Sanitary Association (*U. S. Live Stock Sanit. Assoc. Rpt., 24 (1920), pp. 203, figs. 7*).—The papers presented at the annual meeting held at Chicago from November 29 to December 1, 1920, include the following: Progress of Co-operative Tuberculosis Eradication Work, by J. A. Kiernan (pp. 31–41), Tuberculosis Control from the Viewpoint of the State, by D. F. Luckey (pp. 41–46), The Practitioner as a Factor in Tuberculosis Control, by C. H. Case (pp. 46–51), Pitfalls in Tuberculin Testing, by W. J. Fretz (pp. 56–67), Practical Suggestions in the Control of Infectious Abortion, by J. F. Devine (pp. 78–80), The Accurate Diagnosis of Bovine Infectious Abortion, by F. Huddleson (pp. 80–85), Control of Infectious Abortion in Mares, by E. S. Good (pp. 85–89), The Dissemination of Anthrax Infection through Industrial Sources, by A.

Eichhorn and A. L. Edmunds (pp. 110–120), and Cattle Scabies, Directions and Suggestions for Its Control and Eradication, by B. F. Davis (pp. 123–125).

The reports presented include those of the committees on infectious abortion (pp. 89–99); on demonstration tests of cattle (p. 100); on special skin diseases (pp. 108–109); on tick eradication (pp. 134–138); on infectious swine diseases, including Diagnosis of Pneumonia in Swine, by R. R. Birch (pp. 144–147), Influence of Feed as a Predisposing Factor in Breaks, by R. Jay (pp. 148–150), and Porcine Abortion, by A. T. Kinsley (pp. 151–153); on diseases, with accounts of (1) an unidentified fatal disease of cattle, (2) lymphangitis in cattle caused by an acid alcohol fast organism, (3) infectious abortion in swine, (4) bovine botulism, (5) a nutritional disease of poultry, (6) avian tuberculosis, (7) tetanus, necrobacillosis, and mixed infections, (8) coccidosis in cattle, and (9) special investigations (pp. 154–167); on hog cholera control (pp. 168–173); and on intra- and interstate shipments of swine, including a paper on Prevention of Bruising in Handling Live Stock, by E. S. Waterbury (pp. 173–186).

Report of the territorial veterinarian, L. N. Case (*Hawaii. Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1919–20, pp. 116–143*).—The occurrence of infectious diseases of live stock during the biennium ended December 31, 1920, legislation relating to the control and eradication of bovine tuberculosis, etc., are reported upon.

Report of the veterinary director general, F. Torrance (*Canada Dept. Agr., Rpt. Vet. Dir. Gen., 1919–1920, pp. 49*).—This report includes accounts of the occurrence of the more important diseases of live stock during the two-year period ended March 31, 1920, and of the work conducted.

Yearly reports in regard to the progress made in veterinary medicine, edited by W. Ellenberger, W. Schütz, and O. Zietzschmann (*Jahresber. Vet. Med., 35 (1915), pp. VII+234; 36 (1916), pp. VII+256; 37 (1917), pp. XII+246*).—These reports, in continuation of those previously noted (E. S. R., 34, p. 876), review the work done in 1915, 1916, and 1917, respectively. Bibliographies and author and subject indexes are included.

Pasteur: The history of a mind, È. Duclaux, trans. by E. F. Smith and F. Hedges (*Philadelphia and London: W. B. Saunders Co., 1920, pp. XXXII+363, pls. 16, figs. 22*).—This volume is somewhat more than an English translation of the life of Pasteur by Duclaux, published in 1896, in that it contains a biographical sketch of Duclaux, numerous footnotes indicating progress in certain fields of research, and a list of interesting annotations of the persons mentioned in the book. Two photographs of Duclaux and several of Pasteur are included.

The presence of normal antibodies in the blood, A. Sordelli (*Rev. Inst. Bact. [Argentina], 2 (1920), No. 5, pp. 679–688, fig. 1*).—From literature citations and the results of reported experiments, the author concludes that the amount of normal antibodies in the blood increases regularly with the age of the animal.

Heterogeneous antibodies, III, A. Sordelli and C. E. Pico (*Rev. Inst. Bact. [Argentina], 2 (1919), No. 3, pp. 261–280*).—A continuation of the study of heterolysins (E. S. R., 41, p. 874) is reported with the following conclusions:

Agglutination of lipoid substances obtained by alcoholic extraction of organs or globules and suspension in physiological salt solution can be brought about by heterogeneous antibodies. The phenomenon appears to be due to a reaction between the antigen and the heterogeneous antibody, for it is observed only with sera obtained by immunization with heterogeneous antibodies and extracts obtained from heterogeneous antigens are alone agglutinable. The same conclusion can be drawn from experiences on the fixation of the agglutinating

antibody. This is fixed by sheep and horse globules or guinea pig kidney but not by the globules of cattle deprived of the heterogeneous antigen.

The agglutinating antibody and the hemolysins are both similarly modified by heat, and no difference can be established between them by fractional precipitation. Complement fixation tests have shown that the amboceptor is fixed on the agglutinated particles. Agglutination does not take place in a salt-free medium, but by adding salt to a sensitized extract suspended in distilled water immediate precipitation occurs.

The nature of the heterogeneous antigen: Preliminary note, R. Wernicke and A. Sordelli (*Rev. Inst. Bact. [Argentina], 2 (1919), No. 3, pp. 281, 282*).—Preliminary work on the composition of the heterogeneous antigens in the above investigation is reported. By successive extractions of horse kidney with acetone, alcohol, ether, and benzol, a substance containing nitrogen and phosphorus was obtained which had a remarkable ability to fix heterolysins.

The rate of fixation of complement at various temperatures, R. L. Kahn (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, pp. 168–170*).—In this preliminary investigation of the rate of complement fixation at different temperatures, two purified proteins, edestin from hempseed and phaseolin from the kidney bean, were used as the antigens, with rabbits as the experimental animal. The results obtained indicated that complement fixation proceeds equally well at water bath, room, or ice-box temperature. From 50 to 75 per cent of fixation took place during the first hour, and the fixation was completed in about four hours at ice-box temperature.

The quantitative relation between complement and complement-fixing antibody, R. L. Kahn (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, pp. 170, 171*).—In connection with the above study, a series of complement fixation tests were carried out with complement gradations of 1.25, 1.5, 1.75, and 2 units, the quantity of serum employed being 0.01 cc. "The results obtained thus far indicate that the employment of 2 units of complement in complement fixation tests is too great an excess of this ingredient for correct results in some cases, and that the employment of lesser quantities of complement, properly controlled, would serve as a finer measure of the complement fixing power of a given serum."

Antipneumococcus protective substances in normal chicken serum, C. G. Bull and C. McKee (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, pp. 174, 175*).—The authors report briefly that the serum of the domestic fowl has been found to protect mice and guinea pigs against infection with all serological types of the pneumococcus. That there is apparently a particular protective substance for each type is shown by the fact that serum adsorbed with one type fails to protect against the same type but still protects against other types. Following fractionation of the serum by means of ammonium sulphate and dialysis, the protective substances were found to adhere quantitatively to the water-insoluble globulin.

Accidents, failures, and false failures of vaccination, principally in tropical medicine, J. Blier (*Rec. Méd. Vét., 97 (1921), No. 3–5, pp. 80–84*).—In this general discussion of possible failures following vaccination, the author distinguishes between accidents following closely upon vaccination due to excess of virulence or sensitivity, anaphylaxis, impure vaccine, etc.; true failure of the vaccine; and the so-called false failures due principally to incorrect diagnosis and application of the wrong vaccine. To lessen the number of failures, particularly in tropical practice, the use of more stable vaccines is recommended and also as far as possible the use of multiple vaccines.

A constant-temperature bath for heating blood serum, R. R. Henley (*Jour. Agr. Research [U. S.], 21 (1921), No. 8, pp. 541–544, fig. 1*).—A constant-

temperature bath, which was devised at the Bureau of Animal Industry, U. S. Department of Agriculture, for heating antihog-cholera serum to a temperature of from 58° to 60° C., as in the method described by Dorset and Henley (E. S. R., 35, p. 488), is described and illustrated.

The operation of the bath depends upon the utilization of the vapors of a liquid having a boiling point slightly higher than the desired temperature. For the temperature required in the preparation of antihog-cholera serum, chloroform boiling at 61° was used. The apparatus consists of a liter flask in which the chloroform is heated and a kettle provided with a draw-off valve, a stirrer, and a thermometer, and surrounded by a jacket narrowed at the bottom to fit into the flask of chloroform and provided at the top with an ordinary reflux condenser. In operation the kettle is filled with the serum, the cover and stirrer adjusted and started, the condenser attached, and water allowed to flow through. About 300 cc. of chloroform is placed in the flask, which is then connected with the outer jacket and sufficient heat applied to the flask to keep the chloroform boiling constantly.

When necessary on account of high altitudes to use a liquid with a higher boiling point, a mixture of carbon tetrachlorid and chloroform is recommended, with the precaution that whenever a mixture is used special care should be taken to insure complete condensation of the vapors. In the suggested specifications for the apparatus it is stated that a kettle larger than 10 by 20 in. should not be used and that the diameter should not exceed one-half the height. The kettle should be constructed of a noncorrosive metal without crevices, seams, or corners. The advantages claimed for this apparatus are that "(1) it is of simple construction, (2) is entirely automatic, (3) there is no danger of overheating, (4) any desired temperature is obtained by using a liquid of suitable boiling point, and (5) a minimum of a fluid, which may be expensive, is used to maintain a maximum of another fluid at a predetermined temperature."

A new method for the preparation of serums on a large scale, A. Sordelli (*Rev. Inst. Bact. [Argentina], 2 (1920), No. 5, pp. 673–678*).—A rapid method is described for obtaining large quantities of horse serum, the yield averaging 60 per cent of the original volume of the blood. The method consists in collecting the blood in sodium oxalate, separating the plasma after 48 hours, coagulating it with calcium chlorid, and filtering it through a sterile candle filter. Serums thus obtained are said to be more uniform and to produce serum sickness less frequently than those prepared in other ways.

Vaccines and serums, D. McClure (*Sci. Amer. Mo., 3 (1921), No. 6, pp. 507–511, figs. 4*).—A general discussion of modern methods of preparing commercial vaccines and serums.

Persistence of the germs of antianthrax vaccine in the organism, A. C. Marchisotti (*Rev. Sud-Amer. Endocrinol., Immunol., y Quimioterapia, 4 (1921), No. 2, pp. 49–56*).—Attention is called to the statement of Kraus and Beltrami (E. S. R., 40, p. 582) that in healthy or immune animals vaccinated against anthrax with virulent or attenuated anthrax bacilli, the organisms become so attenuated that strains cultivated from them are avirulent for experimental animals. This statement has been tested and found to be true. The application of it is suggested in determining whether deaths from anthrax subsequent to vaccination are due to the vaccine or to the presence of anthrax bacilli in the body prior to the vaccination. It is thought that death can be attributed to the vaccine only when the strains isolated from the animal correspond in virulence to the vaccine employed.

Testing antianthrax sera by complement deviation, P. Beltrami and J. M. Grassi (*Rev. Inst. Bact. [Argentina], 2 (1920), No. 5, pp. 689–700*).—Experimental data are reported from which the conclusion is drawn that the method

of complement deviation by normal serum or serum of immunized animals with virulent anthrax cultures or vaccines as antigens does not give satisfactory results as a test of the preventive and curative properties of the serum.

Experimental proof of the value of normal bovine serum against anthrax infection, R. KRAUS and BELTRAMI (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 31 (1921), No. 2, pp. 93–107*).—This is a brief review with experimental data of investigations leading to the conclusion that normal bovine serum can be used in place of immune serum in the treatment of human anthrax (E. S. R., 41, p. 284), together with a discussion of papers by Hutyra and Manninger (E. S. R., 43, p. 181), Kolmer et al. (E. S. R., 42, p. 475), and others bearing upon the same subject. The authors reiterate their belief that normal bovine serum is of equal value to immune anthrax serum.

Foot-and-mouth disease, W. NUSSHAG (*Fühling's Landw. Ztg., 69 (1920), No. 17–18, pp. 340–344*).—This is a general discussion of the history of foot-and-mouth disease in Europe and of preventive and curative measures.

Survey of the treatment of malignant foot-and-mouth disease, A. ALIAS (*Berlin. Tierärztl. Wchnschr., 37 (1921), No. 5, p. 51*).—A brief discussion is given of methods used in Germany and Switzerland in the struggle against foot-and-mouth disease.

Chemotherapy in foot-and-mouth disease, K. BRAUN (*München. Tierärztl. Wchnschr., 72 (1921), No. 4, pp. 58–62*).—The intravenous injection of dilute HCl in animals suffering from foot-and-mouth disease is said to have resulted in a marked lowering of the temperature and a decrease in other symptoms, enabling the animals in the fever-free interval to combat the disease successfully.

An experiment on the cultivation of aphthic lymph, M. and K. BERTSCHY (*München. Tierärztl. Wchnschr., 72 (1921), No. 4, pp. 57, 58*).—This is a preliminary announcement of a method of vaccination against foot-and-mouth disease, the technique of which is similar to smallpox vaccination.

Cattle with foot-and-mouth disease are scarified on the shoulder with humanized vaccine. After from 4 to 6 days the vaccine pustules are scraped off into physiological salt solution plus 0.5 per cent phenol and used for the scarification of another animal. After the third passage the vaccine lymph is mixed with the content of pustules rich in aphthae and the mixture triturated and used for another passage. After the fifth or sixth passage the pustules are said to take on the appearance of true foot-and-mouth disease. The authors are of the opinion that lymph obtained from these pustules will be of value in producing active immunity.

Serum against foot-and-mouth disease (Loeffler), F. ROSENBUSCH (*An. Soc. Rural Argentina, 54 (1920), No. 21, pp. 1131–1136*).—A report is given of the application of serum immunization against foot-and-mouth disease on a large scale at the international live stock exposition at Palermo in 1920, using the methods adopted the previous year (E. S. R., 44, p. 478). Of a total of 1,873 cattle thus inoculated, only 26 contracted the disease, and of these 16 within 4 or 5 days after the first inoculation, thus indicating the possibility that they were in the early stages of the disease at the time of inoculation. The procedure is strongly recommended as a precautionary measure at live stock expositions.

The clinical value of the methylene blue reaction and its application to the diagnosis of glanders, G. FINZI and P. CREMONA (*Clin. Vet., Rass. Polizia Sanit. e Ig. [Milan], 43 (1920), No. 17–19, pp. 464–470*).—In applying the methylene blue test to the urine of 13 glandered horses positive results were obtained in all cases, while after the injection of 0.25 gm. of mallein the test became negative. The authors are of the opinion that the reaction can be

used as a test for glanders provided a negative reaction is given in 10 or 12 hours after the injection of mallein.

The action of phenol on fixed rabic virus and the preparation of phenolated antirabic vaccine, V. PUNTONI (*Ann. Ig. [Rome], 29 (1919), No. 11, pp. 730–747, figs. 2*).—A study of the effect of various factors on the action of phenol on rabic virus is reported. The conclusion is drawn that the attenuating and inactivating action increases with the concentration of the phenol, the temperature of the reaction, and the degree of trituration of the nerve substance, and decreases with the concentration of the latter.

A new preventive inoculation against rinderpest, GORDZIAKLOWSKI (*Rec. Méd. Vét., 97 (1921), No. 3–5, pp. 115, 116*).—The author reports considerable success in immunization against rinderpest with defibrinated blood from animals in the second stage of the disease, i. e., in a state of hyperthermia and with morbid symptoms, but before the appearance of dysentery. The blood drawn from the jugular vein was defibrinated, heated for 10 minutes at 55° C. in small tubes placed in a water bath, and finally heated for an hour at 48 to 50°. Each subject was inoculated with 1 cc. of the attenuated blood. Following the first series of vaccination in 28 cattle of a herd in which rinderpest had broken out there were 3 deaths, the remaining animals standing the inoculation well and resisting inoculation 12 days later with virulent blood. In a later experience with 120 head of cattle no fatalities occurred.

The diagnosis of bovine tuberculosis with the antigen of Besredka, C. HRUSKA and W. PFENNINGER (*Ann. Inst. Pasteur, 35 (1921), No. 1, pp. 96–101*).—The complement fixation test for tuberculosis, using the Besredka human antigen with sera of tuberculous cattle, gave positive results in 257 out of 304 cases. With the sera of cattle showing on autopsy no macroscopic lesions, the antigen gave positive results in only 2 out of 90 cases. Compared with the extent of lesions noted on autopsy, the reaction was positive in 60 per cent of advanced cases of ganglionic tuberculosis, in 84 to 95 per cent of cases presenting more extended lesions such as pulmonary tuberculosis, and in 100 per cent of animals with generalized tuberculosis but in a good state of health. The authors are of the opinion that the complement fixation test can render important service in the struggle against bovine tuberculosis, and in the method of extinction proposed by Bang can replace the ophthalmic reaction to advantage.

Investigations with the help of interferometric methods in the study of protective ferments in bovine tuberculosis, P. HIRSCH and R. MAYER-PULLMANN (*Fermentforschung, 4 (1920), No. 1, pp. 64–75*).—Interferometric studies of extracts from the organs of tuberculous and nontuberculous cattle are reported, the results of which are thought to indicate a certain degree of specificity of the ferments in tuberculous organs. The authors are of the opinion that in tuberculosis there are specific ferments for the various partial antigens, as well as proteolytic and lipolytic protective ferments. As in tuberculosis one or more of the antigens may be lacking, so one or more of the specific ferments may be lacking or present in small quantities only.

Friedmann's vaccine and bovine tuberculosis, W. BÖHME (*Berlin. Tierärztl. Wchnschr., 37 (1921), Nos. 12, pp. 133–136; 13, pp. 145–147*).—A review and discussion of literature on the Friedmann method of immunizing against tuberculosis with living turtle bacilli.

Immunization experiments against guinea pig tuberculosis with heterogeneous antigens, W. BÖHME (*Deut. Med. Wchnschr., 46 (1920), No. 43, p. 1187*).—Attention is called to the failures reported by Uhlenhuth and Joetten (E. S. R. 44, p. 682) in attempts to immunize guinea pigs against artificial tuberculosis infection, and a similar series of studies is noted with like results.

A brief report is also given of a study of the effect of heterogeneous antigens as immunizing agents against tuberculosis. Five groups of guinea pigs were injected with various types of pathogenic organisms and subsequently inoculated with living tubercle bacilli. In no case did the previous injection of the heterogeneous antigen result in immunity or a heightened resistance.

Tuberculosis in milk goats, G. E. GOLDEN (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 79–81*).—A brief account is given of cases of tuberculosis found in Iowa in a herd of milk goats which had been imported from Switzerland. The intradermal test applied to the herd of 33 imported does, 8 imported bucks, and 1 native doe showed 6 reactors, all of which gave positive reactions a week later to the ophthalmic test and 3 to the subcutaneous test. On autopsy the 6 reactors showed the presence of tuberculosis lesions. The author is of the opinion that the tuberculin tests should be applied to all milk goats or that the milk from these animals should be pasteurized.

Tuberculosis of goats, C. MURRAY, S. H. MCNUTT, and P. PURWIN (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 82–84*).—A review is given of the literature on tuberculosis in goats, together with brief mention of the cases noted above.

Actinomycosis (lump jaw, big jaw, and wooden tongue), J. W. CONNAWAY (*Missouri Sta. Bul. 186 (1921), pp. 3–16, figs. 9*).—This is a popular summary of information on the subject.

Efficiency of the agglutination test for contagious abortion of cattle, D. H. JONES (*Sci. Agr., 1 (1921), No. 1, pp. 37, 38*).—The agglutination test for contagious abortion was conducted in the summer of 1920 on a herd of 33 purebred beef cattle, including Shorthorns, Aberdeen-Angus, and Herefords, and on a herd of 34 purebred dairy cattle, including Holsteins, Ayrshires, and Jerseys. A comparison of the findings of these tests with the previous history of the individual breeding cows gave a percentage efficiency of 63.6 in the case of beef cattle and 84 with the dairy cattle. In the first group the 8 calves tested gave a negative, 2 yearlings which had not been bred a positive, and one a negative reaction. In the second group 3 yearlings gave a negative, one a positive, and one a doubtful reaction. The author is of the opinion that segregation of positive reactors to the agglutination test for contagious abortion would be of great help in the attempt to eradicate the infection from a herd.

Statistical observations on the Texas fever parasite, H. CRAWLEY (*Acad. Nat. Sci. Phila. Proc., 72 (1920), pt. 3, pp. 331–336*).—This is a report of studies, the results of which are largely presented in tabular form. The studies deal with the relative numbers of parasitized and nonparasitized cells, the number of individual parasites in each parasitized cell, and the varying conditions found in the several organs.

The etiology of black disease, being further studies in a braxy-like disease of sheep, S. DODD (*Jour. Compar. Path. and Ther., 34 (1921), No. 1, pp. 1–26, figs. 6*).—This is a report of investigations conducted, in continuation of those previously noted (E. S. R., 39, p. 686), which have led to the conclusion that black disease is a condition apparently peculiar to sheep and of seasonal occurrence. "It is a toxaemia with an acute course. The primary lesions are situated in the liver and consist of circumscribed areas of necrosis. One or several such lesions may be present. Other lesions seen elsewhere must be looked upon as secondary, and probably due to the action of the toxin produced by the bacilli in the primary lesion and distributed in the blood stream.

"At the time of death the causal organisms are confined to the primary hepatic lesions and can not be demonstrated elsewhere, even in the liver, but in rare cases the bacilli may be found in that organ although it presents no gross necrotic foci. These may be looked upon as cases of mass infection, in which

the defences of the organ have been overwhelmed before they could come into action. The causal organism is one of the larger anaerobic bacilli; it sporulates readily and is probably a facultative parasite.

"Experimental inoculation of virulent cultures is fatal to sheep and other animals, and the lesions thus produced are anatomically identical with those of black disease. Such differences as exist are due to the port of entrance of the bacilli and the nature of the tissues there. (Compare contagious bovine pleurapneumonia.) The situation of the primary lesions and the failure to infect by feeding experiments with virulent cultures or viscera of affected animals suggest the probability of a carrier; and the seasonal character of the disease, the geographical features of infected paddocks, and the presence of fluke disease, indicate that the liver fluke is the mechanical carrier.

"Black disease is probably identical with the braxy-like diseases in Tasmania and Victoria, although the organism claimed to be the cause of the latter is not identical with that isolated from the former. Until more definite information is obtainable regarding braxy or bradsot by investigations in which the possibility of post-mortem invasion has been eliminated, it is not possible to decide whether the European disease is the same as that seen in Australia. It is, however, quite probable that it is."

Injections in the horse of equine streptococci treated with alcohol-ether, Brocq-Rousseu (*Compt. Rend. Soc. Biol.* [*Paris*], *84* (*1921*), *No. 9, pp. 445, 446*).—The author reports a successful experience in inoculating a horse with gradually increasing though minute doses of *Streptococcus equinus* killed by alcohol-ether and emulsified in physiological salt solution. Injections of this emulsion into the jugular vein caused no inconvenience. The lower temperatures obtained in the third series of inoculations indicated that the animal had apparently acquired a certain degree of immunity. The method is thought to be of promise for the preparation of a serum active against equine streptococci, particularly those involved in strangles.

Immunological studies against epizootic meningo-encephalitis of equines (Borna disease), II, R. Kraus and P. Beltrami (*Rev. Inst. Bact.* [*Argentina*], *2* (*1920*), *No. 5, pp. 701–712*).—Continuing the investigation of Borna disease (E. S. R., 44, p. 280), the authors report that the serum of horses immunized against the disease has specific agglutinating and complement deviating properties and can consequently be employed as a diagnostic measure with the diplococci cultivated from the brains of animals dead from the disease. The serum either alone or with the living organisms can also be employed as a preventive agent.

Vaccination against contagious epithelioma of fowls, J. V. Negrete (*Rev. Inst. Bact.* [*Argentina*], *2* (*1920*), *No. 5, pp. 713–720*).—The immunizing agent with which the author claims to have had success, both as a preventive and a curative measure, is prepared by triturating with physiological salt solution material from the pustules of an infected bird, heating the emulsion in a water bath at 100° C. for 1 to 2 minutes, and decanting. The clear liquid thus obtained is injected subcutaneously in one side of the breast, and after 5 to 8 days a second injection is made in the other side. The only reaction noted is a coloration at the point of injection except in rare cases, where a mild manifestation of the disease occurs, disappearing in a few days. Data are presented which indicate that the same vaccine has also a curative power.

Summer health means winter eggs, G. W. Hervey (*New Jersey Stas., Hints to Poultrymen, 9* (*1921*), *No. 10, pp. 4*).—Attention is called to the care that should be given fowls in summer, including the importance and manner of combating intestinal worms, close confinement for protection against rose bugs, ridding the flock of vermin, and disinfection of the house.

RURAL ENGINEERING.

Annual report of the American Engineering Standards Committee, 1920 (*Amer. Engin. Standards Com. Ann. Rpt., 1920, pp. [12]*).—This report includes a list of standards approved, standards submitted for approval by the committee, and projects in hand. In addition, the rules of procedure for the committee are set forth as revised in October, 1920, together with the text of the constitution of the committee, revised August 16, 1919. The functions of the American Engineering Standards Committee, which consists of some 17 major organizations, are to unify methods of arriving at engineering standards, to secure cooperation between various interested organizations in order to prevent duplication of work and promulgation of conflicting standards, to act as an authoritative channel of cooperation in international engineering standardization, to promote a knowledge of American engineering standards in foreign countries, to collect and classify data on standards, and to act as a bureau of information regarding standardization.

Fifteenth biennial report of the State engineer of Wyoming, F. C. Emerson (*Wyo. State Engin. Bien. Rpt., 15 (1919–20), pp. 88, pls. 12*).—This report deals with the activities and expenditures of the office of the State engineer of Wyoming for the years 1919 and 1920.

New measurements of flow of spring, stream, and ground water, R. Müller (*Gsndhts. Ingen., 43 (1920), No. 48, pp. 563–568, figs. 13*).—Methods for determining the flow of wells, springs, and small streams with very little fall are described, and tabular data and diagrammatic illustrations of apparatus are given.

Stream gauging records, R. Follansbee (*Wyo. State Engin. Bien. Rpt., 15 (1919–20), Sup. B, pp. 96*).—A report on the surface waters of Wyoming for the 2-year period ended September 30, 1920, is presented, which covers the results of work done under a cooperative agreement between the U. S. Geological Survey and the office of the State engineer of Wyoming.

The results of measurements of flow made on streams in the State are given. A report is also included on studies of seepage and return waters in Wyoming streams during 1920.

Irrigation in India (*Simla: Pub. Works Dept. Govt. India, 1919, pp. [3]+29+24, pls. 4*).—This is the first supplementary report on the work, expenditures and revenues, and irrigation operations in India as a whole and in the various provinces during the year 1918–19.

Farm drainage, W. L. Powers and W. Cretcher (*Oregon Sta. Bul. 178 (1921), pp. 47, figs. 33*).—This bulletin describes different types of wet land in Oregon, points out the need and value of drainage for each type, and reports certain experiments to determine the most suitable depth, distance apart, and sizes for field drains. Data are also included on methods of installation and cost.

The chief wet soils of the State are said to be the white land of the Dayton soil series, the peat and muck soils of the marsh, tide, and overflowed areas, and the alkali areas of the irrigated sections. Studies of subsoil and ground water in white land generally show a friable streak of from 33 to 36 in. depth, and show also that tile placed in these areas have lowered the water table most promptly. The water table is lowered for 25 to 30 ft. back from the tile within 24 hours after saturation. A depth of about 36 in. and a distance between tile lines of from 60 to 66 ft. have been found most effective for lateral drains in typical white land, while deeper drains are desirable in the less retentive areas.

Experiments indicate a suitable depth for tile to be 4 ft. and a distance of 80 ft. for tide land, while in irrigated lands, as in the Malheur Valley, drains

from 8 to 9 ft. deep have controlled the water table for a distance of 660 ft. laterally.

Measurements of outflow in the Willamette Valley, reported by F. F. Henshaw, indicate that main drains should have a capacity of from $\frac{1}{3}$ to $\frac{1}{2}$ acre-inch run-off to the acre in 24 hours for areas up to 40 acres and $\frac{1}{3}$ in. for larger fields, as the total percentage of run-off in the Willamette Valley is large. On the coast $\frac{3}{4}$ to 1 in. is a suitable drainage coefficient.

The location, grading, and drainage of highways, W. G. HARGER (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XIII+294, pls. 2, figs. 162*).—The author states that this book is the first of a series of four volumes presenting the road problem from the standpoint of the constructing engineer.

This volume covers a discussion of general principles governing the policy of highway programs, such as the scope of the program, general character of the system, classification, layout, appropriation estimates, fundamental principles of design, and reasonable economy in design. The theory of economic location and grade line design is developed from the standpoints of both horse and motor traffic, and cross sections, roadway widths, right of way, and drainage are discussed. It is intended to cover concisely the principles of design of the relatively permanent features of highway construction. Theory is developed but is used largely as a basis for judgment, and is illustrated by current and recommended practice. Emphasis is laid on the desirability of making appropriations accomplish as much as possible, and the engineering means to this end are indicated.

Modern road building and maintenance, A. P. ANDERSON ([*Wilmington, Del.*]: *Hercules Powder Co., (1920), pp. 146, pls. 16, figs. 20*).—This book is devoted to setting forth the basic principles underlying road building and maintenance and calling attention to the meaning of the more important results of present-day experience. It is apparently based largely on the work of the Bureau of Public Roads of the U. S. Department of Agriculture, and the majority of the illustrations have been reproduced from the photographic file of that bureau.

It consists of five parts. Part 1, on planning the road, contains chapters on economic and social considerations; economic problems of the heavy motor truck; physical resistances to traffic; selecting the type of road surfacing; effect of the motor truck on different road surfaces; road widths and crown; and surveys, plans, and specifications. Part 2, on road materials, contains chapters on road building—rocks; Portland cement; petroleum and residuum; and asphalts and tars. Part 3, on road construction, contains chapters on organization and equipment of the working force; cleaning and grubbing the right of way; drainage; quarrying and crushing stone; earth work; earth roads; sand-clay roads; gravel roads; water-bound macadam; bituminous road surfaces; bituminous surface application; concrete roads; brick roads; and bridges and culverts. Part 4, on road maintenance and repair, contains chapters on organization of the working force; patrolmen; patrol maintenance of earth roads; and maintenance of surfaced roads. Part 5, on the use of explosives, contains chapters on the use of explosives in planning and preparing the right of way; use of explosives in earth and rock excavation; use of explosives in rock quarries and material pits; miscellaneous uses of explosives in road work; and a description of various explosives and accessories used in road building.

Grading road with tractors and wheel scrapers, W. D. HILL, JR. (*Pub. Works, 50 (1921), No. 20, pp. 406–408, figs. 2*).—Data from the use of two outfits of a tractor and two trailers each for hauls exceeding 150 ft., showing the force employed, dirt moved, and dynamometer results, are reported. A 5-ton caterpillar tractor hauling two 4-wheel scrapers moved 262 cu. yds. of dirt per

10-hour day a distance of 300 ft., 214 cu. yds. 600 ft., 160 cu. yds. 900 ft., 122 cu. yds. 1,320 ft., 96 cu. yds. 1,800 ft., and 68 cu yds. 2,640 ft. When hauling three scrapers through the same distances 360, 270, 210, 150, 120, and 90 cu. yds. of dirt were moved, respectively, per 10-hour day. The dynamometer tests showed that the pounds pulled on the drawbar of the tractor when loading the first scraper were 4,960 at a speed of ½ mile per hour, when loading the second scraper 4,520 lbs., and when loading the third scraper 4,800 lbs. The average drawbar pull when hauling three loaded scrapers at 3 miles per hour was 2,140 lbs., when dumping at 3 miles per hour 2,540 lbs., when turning empty 1,160 lbs., and when returning empty 928 lbs. The return empty was made at the rate of 5.71 miles per hour.

Second biennial report of the California Highway Commission, N. D. DARLINGTON ET AL. (*Calif. Highway Comn. Bien. Rpt., 2 (1919–20), pp. 163, pls. 2, figs. 66*).—This report deals with the work and finances of the California Highway Commission for the biennial period ended December 31, 1920.

Second annual report of the State Highway Department of Georgia (*Ga. Highway Dept. Ann. Rpt., 2 (1920), pp. 175, pl. 1, figs. 58*).—The operations and finances of the Georgia State Highway Department for the fiscal year 1919–20 are covered in this report.

Second biennial report of the [Texas] State Highway Commission, R. M. HUBBARD ET AL. (*Tex. State Highway Comn. Bien. Rpt., 2 (1919–20), pp. 104, pls. 4, figs. 9*).—This report covers the financial accounts and physical activities of the Texas Highway Department for the period from December 1, 1918, to December 1, 1920.

Progress in investigation of alkali action on concrete, E. C. BEBB (*Reclam. Rec. [U. S.], 12 (1921), No. 5, pp. 224–227, figs. 3*).—A brief progress report is presented on the cooperative studies being conducted by the U. S. Bureau of Standards, the U. S. Department of Agriculture, and the U. S. Reclamation Service on the action of alkali on concrete.

The results indicate that if cement draintile are to be used in soils and waters containing 0.1 per cent or more of sulphate salts, their installation should be preceded by an examination of the subsurface conditions. In all cases where disintegration of the best quality of tile has occurred, samples of the soil immediately in contact with such tile have revealed concentrations much higher than are indicated by the drainage water. The presence of over 5 per cent of soluble salts in the soil immediately above the tile is said to certainly result in destructive concentrations when sufficient seepage water is present. To date the best results have been obtained from handmade tile of quaking or mushy consistency and from tile made on a tamping machine. In general, the use of tile made from mortar of plastic consistency, such that the jacket can be removed immediately after molding, is not recommended for use in sulphate soils and waters.

Experiments with concrete test blocks seemed to indicate that surface disintegration of the poorer grades of concrete begins with concentrations of about two-tenths of 1 per cent in waters of the sulphate type, and that the severity of the action increases as the salt concentration increases until with concentrations of from 2 to 3 per cent even the best concrete disintegrates rapidly. Durability under such circumstances appears to depend upon impermeability, which in turn depends mainly upon richness of mixture and gradation of aggregates.

Inspections of draintile and concrete structures in localities where the alkali salts are of the chlorid or carbonate types led to the conclusion that these salts are not so severe as sulphate salts.

Tests on the utilization of vegetable oils as a source of mechanical energy (*Bul. Matières Grasses Inst. Colon. Marseille, No. 1 (1921), pp. 4–14*).—Tests by Mathot with palm and cotton oils are reported, in which it was found that the consumption of either fuel by a 4-stroke cycle, 25 h. p. motor with from 49 to 53 lbs. compression was 265 gm. per horsepower hour, with an explosion pressure of from 359 to 397 lbs. per square inch. With a 2-stroke cycle, 16 h. p. motor with compression of from 22 to 26 lbs. the consumption was 320 gm., and with a 2-stroke cycle, 33 h. p. motor with compression of from 44 to 48 lbs. the consumption was 285 gm. The gasoline consumption in all three engines was 254, 236, and 240 gm., respectively, corresponding to a thermal efficiency of about 27 per cent. The thermal efficiencies using vegetable oils were 23, 27, and 25 per cent, respectively.

Experiments on the gasification of palm oil, by T. d'Althoff, and on engine operation with this fuel, by Trentels, are also discussed.

Tests of an internal-combustion motor using palm oil fuel, Goffin (*Bul. Matières Grasses Inst. Colon. Marseille, No. 1 (1921), pp. 19–24*).—Tests of a 2-stroke cycle gas engine of from 8 to 10 effective horsepower, modified for the use of palm oil fuel, are reported. Water injection into the combustion chamber was provided for.

It was found that the motor operated as well on palm oil as on gasoline. The injection of water did not decrease misfiring. The fuel consumption was 340 gm. per horsepower hour, the consumption of injected water about 100 gm., and of lubricant about 23 gm. The mechanical efficiency was about 80 per cent and the thermal efficiency about 20 per cent.

The farm electric plant, F. E. Fogle (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 119–121*).—A brief analysis of the costs which enter into the production of electrical current by a gasoline or kerosene farm electric plant is given. The analysis is based upon tests of nine different plants for periods varying from 60 to 130 minutes. The average watts produced during these tests varied from 688.57 to 1,102.37, and the gasoline consumption from 0.279 to 0.756 gal. The gasoline consumption per kilowatt hour varied from 0.261 to 0.628 gal., and the cost of fuel per kilowatt hour at 26 cts. per gallon from 6.75 to 16.32 cts. On this basis the maximum cost per kilowatt hour is estimated at 45.67 cts.

The farm power problem, H. R. Tolley (*Jour. Farm. Econ., 3 (1921), No. 2, pp. 91–99*).—This paper has been previously noted (E. S. R., 44, p. 197).

Sweet potato storage in Delaware, T. F. Manns (*Delaware Sta. Bul. 127 (1920), pp. 8–64, figs. 46*).—General information on diseases of sweet potatoes is given, and investigations conducted in cooperation with the U. S. Department of Agriculture on the relation of moisture, temperature, and ventilation to the storage rots of sweet potatoes as factors to be considered in storage-house design and construction are reported. The efficiency of a large three-floor commercial storage house 40 by 60 ft. was also compared with that of a small house suitable for the farmer growing from 10 to 20 acres.

In the moisture studies it was found that in a house properly ventilated the moisture is given off most rapidly during the early part of the storage period. In the large house during the first month 7.43 per cent of the weight of the potatoes was given off as moisture, and during the next 46 days 5.33 per cent. These results are taken to indicate that the moisture given off in the first three months from an efficient storage will vary from 10 to 16 per cent of the weight of potatoes stored. Under Delaware conditions one-half of this amount may easily be removed during the first month of storage by taking advantage of natural ventilation. Under average storage conditions in Delaware, from December 1 to February 1, it requires a movement of 5,000 cu. ft. of air through the storage house to carry out a pound of moisture. These results indicate that

overcrowded houses are difficult to ventilate adequately and that at least 3 cu. ft. of space should be allowed for each bushel of sweet potatoes stored.

A comparison of moisture loss from bin storage with that from basket storage showed that sweet potatoes stored in baskets or hampers gave off much more moisture than when stored in bins.

Further studies showed that the amount of black rot and soft rot is intimately related to the amount of moisture in the potatoes.

Studies on forced ventilation by means of a 12-in. turbine centrifugal, electric motor fan, having a lifting capacity of 2,000 cu. ft. of air per minute, showed that the humidity was not lowered any more rapidly by means of the fan than could be done by means of stoves and proper air shafts. It was concluded that since heat must be applied to the house during the late fall and winter storage, such heat would produce sufficient movement of air provided proper ventilating openings were supplied. The only advantage obtained from the use of such a fan was that the air was drawn equally from each floor and from all parts of the house, and the fan could be used on days when no heat was required.

Regarding the control of moisture and temperature under commercial storage-house conditions, studies showed that it is more difficult to control humidity properly on the first floor than on the second floor.

Studies on the fundamentals of storage-house construction indicated that there must be adequate protection against frost and chilling, the house must be weatherproof for economy in the use of fuel, and there must be adequate ventilation. Proper protection against storm and frost is provided in Delaware by constructing walls with 4 or 6-in. studding ship-lapped or box boarded on the outside and covered with waterproof tarred building paper and a good grade of weather boarding. The inside of the studding is covered with building paper and ship-lapped. The floor construction should be double and the roof should have the same construction as the walls except that shingles take the place of weather boarding. An air space between walls and bins of from 12 to 24 in. should be maintained to give ample circulation of heat and air. Adequate ventilation can not be provided in large storage buildings without bottom intake ventilators and top foul air escape ventilators.

Double walls from 2 to 4 in. apart should be maintained between all bins, and removable double walled door partitions should be constructed every 3 or 4 ft. in bins 6 ft. or longer. Removable or hinged and slatted false floors 4 in. above the permanent floor should be constructed for every bin, and a space of 12 in. or more should be left between the top of a bin and the ceiling or roof.

Drawings of small and medium sized storage houses are included. It is stated that the studies as a whole have shown that even greater efficiency has been maintained in the properly constructed and manipulated large commercial house than in the smaller ones.

The activated sludge process of sewage treatment: A bibliography of the subject, J. E. Porter (*Rochester, N. Y.: General Filtration Co., Inc., 1921, 2. ed., pp. 117*).—This is the second edition of this work (E. S. R., 38, p. 691).

RURAL ECONOMICS AND SOCIOLOGY.

Agricultural economics, J. E. Boyle (*Philadelphia and London: J. B. Lippincott Co., 1921, pp. IX+448, figs. 90*).—This volume is intended to present to the average student of agricultural problems a certain amount of compiled information and discussion of social and economic aspects of agriculture, including size of farms, tenancy and land ownership, economic returns, farm labor problems, and others. The increased use of machinery is pointed out, and the

growth of machinery trusts is described. Chapters are devoted to accounts of individual State marketing activities, marketing devices, and costs. Other topics treated are cooperation, credit, transportation, insurance, storage, and agricultural prices and valorization.

The author emphasizes somewhat a present tendency toward capitalistic agriculture, and points out that the farmer's economic income is low, and claims that crops, especially wheat, may be marketed as profitably at or near harvest time as six months or more later. He concludes that collective bargaining, especially on the basis of a sliding scale representing cost of production and demand, is to be preferred to governmental interference in price fixing. Farm accounting, speculation in agricultural products, the agricultural press, farmers' organizations, State aid, and the organization and operation of the grain trade and of the live stock and meat industry are considered. Arguments are presented for and against the single tax and protective tariff as agricultural issues. Foreign competition of Canada, Argentina, and Russia, and the world food supply problem are discussed.

Buying farms with land-bank loans, L. C. GRAY and H. A. TURNER (*U. S. Dept. Agr. Bul. 968 (1921), pp. 27, figs. 6*).—This study is based on the experience of 2,700 farmers who have borrowed money through Federal loan banks, and attempts to indicate what proportion of those borrowing under the Federal farm loan system for the purpose of buying land were landless farmers with limited capital, what methods such persons have employed to supplement the funds obtained from the Federal land banks, and what have been the costs of such loans to the borrowers.

An analysis of 78 per cent of the total number of loans from the time of the organization of the Federal land banks to November 30, 1919, indicates that only 13 per cent of the amount thus loaned was for the purpose of purchasing farm land. As regards one-third of the loans made prior to November 30, 1918, only 8 per cent of the proceeds were used for buying farm land.

It is brought out that only one-third of 2,054 borrowers purchasing land belonged to the landless class. Of this number 36.6 per cent were tenants, 37.9 per cent tenants who owned other farm land, and 62.1 per cent were landless tenants, while in the case of nontenants, the percentage owning other farm land amounted to 83.5.

In the case of 1,168 loans, the average percentage which the first mortgage represented of the value of the land bought is given. For owner buyers the loan was 41.5 per cent of the value, while nonowning buyers appear to have made loans averaging 44.2 per cent of the land bought.

Information regarding the cost of Federal farm loans was received from 1,765 borrowers. On the basis of these replies, the average cost is said to have amounted to $50.84, or 1.43 per cent of the mortgage given to the Federal land bank, which averaged $3,541. There were, however, 347 borrowers giving mortgages of $1,000 or less to whom the loans cost an average of $36.01, or 4.82 per cent of the mortgage given. On the other hand, while the cost of borrowing averaged $82.74 for the 187 who gave mortgages to the Federal land banks for amounts between $7,501 and $10,000, this cost represented only 0.9 per cent of the mortgage given.

One thousand and eight replies are used to determine the extent of the use of the second mortgage in order to complete the purchase. Of this number, 477 did not involve second mortgages. In practically 78 per cent of the cases, the second mortgage was given to the sellers of the land. In the case of those buyers giving no second mortgage, the remainder of the purchase price was paid in cash or by trading other property. The amount put in by the second group in cash or trade averaged 24.4 per cent of the cost of the farm.

The period of repayment and provisions for periodic repayment of second mortgages are analyzed in detail from records obtained.

The interest rates on second mortgages were found to average 6.8 per cent, and it is brought out that this is slightly lower than that on first mortgages. It is said that this tendency to close approximation has been confirmed by a recent survey of land sales in Iowa, where the average rates on second mortgages proved to be 5.7 as compared with 5.3 for first mortgages (E. S. R., 43, p. 893).

The Federal farm loan case, H. H. PRESTON (*Jour. Polit. Econ., 29 (1921), No. 6, pp. 433–454*).—The history and issues of the suit involving the constitutionality of the Federal Farm Loan Act are set forth, with a brief outline of the operations of the system and discussion of the policy of tax exemption and needed changes in the law. It is concluded that in the matter of tax exemption more liberal conditions are granted than are warranted, and that careful consideration should be given to the matter henceforth; also that the status of the joint-stock land banks should be settled clearly.

Rural credit in the Philippines, M. CRETCHER (*Trop. Agr. [Ceylon], 56 (1921), No. 1, pp. 53–59*).—The recent organization of credit societies under the provincial government and the progress of the movement fostering these institutions are set forth.

The cooperative movement as affecting agriculture (*India [Dept. Agr.] Rev. Operations, 1919–20, pp. 73–81*).—Brief notes are given reporting the progress of agricultural credit and other societies in 1919–20 by provinces of India.

Methods of renting land in Ohio, J. I. FALCONER (*Ohio Sta. Bul. 348 (1921), pp. 101–130, figs. 6*).—In this bulletin is set forth the nature of farm rental contracts as they now exist in Ohio, on the basis of information from about 1,000 farm management survey records, from the examination of more than 200 leasing contracts, and from discussions with tenants and landlords. Census figures are presented to indicate that practically two-thirds, or 69.1 per cent, of the tenanted farms in the State were operated on the share-rent basis in 1920, landowners and tenants preferring this system for economic reasons of their own. Methods of letting land on shares are described in detail. Provisions most frequently found in Ohio farm leases are briefly enumerated and discussed.

Experiments are said to indicate that approximately 50 per cent of the benefits derived from fertilizers and manure in an ordinary Ohio rotation is recovered in the crops to which they are applied, while 50 per cent is recovered in subsequent crops. The author believes that the tenant should be compensated for his expense for fertilizers in case he does not receive his share of their benefits.

Agriculture and landownership in Poland, H. ARCTOWSKI (*Geogr. Rev., 11 (1921), No. 2, pp. 161–171, figs. 4*).—Statistical data on population and agriculture in Poland, compiled originally for the American Delegation to the Peace Conference, are given in part in this article, illustrated with a number of distribution maps showing the per capita production of food crops per year in recent years and averages for periods of years. It is indicated that the republic is self-sustaining in agricultural production, although progress and agrarian reform together with improvement in crop yields are needed.

The farmer and the single tax, J. R. BROWN (*New York: Manhattan Single Tax Club [1919], 2. ed., pp. 10*).—This sets forth ways in which, in the author's estimation, the farmer would be relieved of much of his tax burden under the single-tax system.

Standards of labor on the hill farms of Louisiana, M. B. OATES and L. A. REYNOLDSON (*U. S. Dept. Agr. Bul. 961 (1921), pp. 27, figs. 7*).—This bulletin is a statement of the prevailing standards of labor for crews of various sizes at

field and crop work and the labor requirements of crops per acre in the hill sections of northwestern Louisiana. The data were obtained by personal interviews with farmers. Six hundred and seventy-seven detailed reports on the principal crops grown were obtained.

Graphic illustration of farm management, A. BRACKE (*Jour. Soc. Natl. Agr. Belg., 2 (1920), No. 45, pp. 398–400, figs. 2*).—A hypothetical case is illustrated graphically and described in an elementary way to indicate for Belgium farmers the seasonal man and horse labor requirements in the conduct of several farm operations.

Mixed farming and apple growing in Ontario, H. W. CLARKE and A. LEITCH (*Ontario Dept. Agr. Bul. 282 (1921), pp. 23*).—This investigation was carried out similarly to that previously noted (E. S. R., 44, p. 191), on 35 orchard farms depending almost entirely on apples as their main source of income, and 165 mixed farms on practically all of which the orchard was an important enterprise. These farms are situated mainly in Clarke and Darlington townships in Durham County, Ontario, a few being in the vicinity of Brighton, Northumberland County.

Group 1, consisting of those of the 165 farms in the survey known as the mixed farms containing under 76 acres, had an average labor income of $511 per farm, and in succeeding groups there was a steady increase, with the exception of group 5 (136–160 acres) where the poor live stock factor operated to decrease returns, until a group of farms of over 160 acres was reached with an average labor income of $1,315. It is indicated that higher returns are possible from the larger farms with a comparatively small increase in farm expenses. Farmers on the small farms in group 1 were able to produce 34.5 acres of crops per man, while each succeeding group showed an increase in the amount of crops one man was able to work, the maximum being reached in the last group where each man produced 52.9 acres of crops. From a study of the 35 orchard farms it was found that the development of the orchard business, especially on farms of the smallest size group, gives an opportunity for a larger net income.

Tables are given in which it appears that the group of 25 farmers whose crops were less than 80 per cent of the average made a wage of $230 for their year's work. The next group of 42 men, whose crop average was between 81 and 93 per cent of the average, made $725 for their year's work. The amount of the labor income rose steadily with the increase in quality of the live stock, from $143 on those farms where the stock returned less than $74 per unit to $1,679 where the stock returned over $109 per unit. The figures indicate increases of $455, $592, and $717 which can be credited to the growing of better crops, and of $985, $1,227, and $1,344 which can be credited to the keeping and breeding of better live stock, all about twice the increases due to the growing of better crops. It is concluded, therefore, that the greatest single factor for successful live-stock farming, either beef or dairy or mixed, is a higher quality of live stock.

Considerable data on the cost of production of apples and the effect of yield on cost per bushel are tabulated.

Beef cattle feeding costs, R. H. WILCOX (*Jour. Farm. Econ., 3 (1921), No. 2, pp. 62–72, fig. 1*).—The paper previously noted (E. S. R., 44, p. 197) is published in these pages with tabulations of the data used, together with a chart illustrating monthly prices of cattle and feeding stuffs, 1915–1920.

The packer and the farmer, W. Y. DURAND (*Jour. Farm. Econ., 3 (1921), No. 2, pp. 49–61*).—The paper previously noted (E. S. R., 44, p. 197) is published here.

Speculation and the Chicago Board of Trade, J. E. BOYLE (*New York: Macmillan Co., 1920, pp. XI+280, figs. 22*).—An ideal market is defined as one

functioning to establish the equilibrium price which will coordinate consumption and production and move the whole crop into consumption without a loss, shortage, or carryover, and considered in the light of this standard, the Chicago Board of Trade is said to perform economically and efficiently the fundamental functions of a market. Chicago's geographical position as determining its development as a cash grain market, and the growth of competition as affecting future trading for hedging and speculative purposes are noted. Speculation and future trading are said to be sound factors of certainty and stability in cash grain marketing, as well as a form of insurance. Extensive citations from the press, government and private market quotations, reports, and other sources are given in the body of the report, as well as in appendixes.

The trend of prices, N. C. MURRAY (*Jour. Farm. Econ., 3 (1921), No. 2, pp. 73–81*).—The statistical study previously noted (E. S. R., 44, p. 197) is published in these pages.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 4 (1921), Nos. 5, pp. 65–80; 6, pp. 81–96; 7, pp. 97–112, figs. 3; 8, pp. 113–128*).—The usual abstracts of information of domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products are given in these numbers, together with analyses of foreign market conditions. Two brief articles of special interest in No. 6 describe Boston as the largest port for imported potatoes and as holding fourth place as a potato-consuming market, and give a summary of advances by the War Finance Corporation for the financing of agricultural exports. In No. 8 is a brief article on the potato market in Kansas City.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), Nos. 7, pp. 73–88, figs. 4; 8, pp. 89–104, figs. 5*).—The usual monthly estimates of acreage, condition, and yields of crops with summaries and comparisons over various periods, as well as data relating to farm value and prices received for farm products, and the number of live stock are presented in these numbers. In No. 7 is included a brief note setting forth the gain in population over the increase of the wheat yield per acre, accompanying a table showing production per capita and per acre per 1,000,000 of the population and consumption per capita and as a percentage of production for periods of years beginning with July, 1866, and ending with July, 1920. A report is also given covering the use of fertilizers in cotton States in 1921, as compared with preceding years. No. 8 contains an article on the value of agricultural exports related to production.

Missouri farm review for the year ending December 31, 1920, E. A. LOGAN and J. MAYES (*Missouri State Bd. Agr. Mo. Bul., 19 (1921), No. 2, pp. 91, figs. 23*).—This statistical report is made by the State cooperating with the U. S. Department of Agriculture.

A statistical handbook of Ohio agriculture, W. F. CALLANDER (*Ohio Dept. Agr. Off. Bul., 14 (1921), No. 3, pp. 65–148, figs. 37*).—This report is made by the State in cooperation with the U. S. Department of Agriculture for 1919 mainly from census statistics and for 1920 on the basis of estimates of crop and price correspondents and acreage returns reported by the assessors. A number of comparative tables are given showing the acreage, production, and yields of the principal crops in Ohio since 1866, also the number of live stock on farms since 1846. A series of average yield charts, as well as graphic maps and charts showing the development of the live-stock industry and acreage of the principal crops, are included.

[Agricultural statistics of Switzerland] (*Statis. Jahrb. Schweiz. 26 (1917), pp. 80–103; 27 (1918), pp. 73–90*).—These pages continue statistical information previously noted (E. S. R., 38, p. 695).

Statistics of production of cereals and legumes, 1919 and 1920 (*Estadística de la Producción de Cereales y Leguminosas. Madrid: Junta Consult. Agron., 1919, pp. 41; 1920, pp. 39*).—These reports continue data on agricultural production in Spain previously noted (E. S. R., 40, p. 793).

The organization of statistics in Spain, F. DE A. RODÓN (*Estudio, 25 (1919), pp. 293–334*).—In this study the many statistical publications issued by the different ministries are described with a view to their possible coordination under one central bureau of government statistics.

[Development of agriculture in China] (*World Agr., 2 (1921), No. 1, pp. 92–96, figs. 4*).—Two brief articles are given in these pages, namely, Government Preventive Measures Against Famines in China, by I. C. Suez (pp. 92, 93), which is a report of early measures, and China's Place in World Agriculture, by G. W. Groff (pp. 94–96), which discusses hte agricultural development of western China.

[Crop production in the Philippine Islands, 1920], A. HERNANDEZ (*Philippine Bur. Agr. Ann. Rpt., 20 (1920), pp. 11–19, pls. 8, figs. 7*).—Statistics of the production of principal crops by provinces are given and illustrated with maps prepared by A. Peña and with charts.

Managing a community fair, C. R. HOFFER (*Iowa Agr., 22 (1921), No. 4, pp. 125–127, figs. 2*).—A suggested program is given with descriptions of exhibits, recommendations of methods of advertising, etc.

AGRICULTURAL EDUCATION.

Annual report of the director of agricultural extension, 1920–21, B. H. CROCHERON (*Calif. Univ. Agr. Ext. Ann. Rpt., 1921, pp. 24*).—The development of some phases of agricultural extension work in California is noted briefly, especially that of the farm bureaus and the contest plan as used in club work and among adult growers. The efforts of extension workers in demonstrating results of investigations at the experiment station are reported on by projects.

The report of the extension service for the year ended November 30, 1919, K. L. BUTTERFIELD (*Mass. Agr. Col. Ext. Rpt. 1919, pp. 32*).—This part of the fifty-seventh annual report of the Massachusetts Agricultural College sets forth the administration of the service and the work of specialists and county agents by projects. A brief statistical report is included.

Club work was carried on in home economics, canning, pig raising, poultry, calf raising, and home gardening, 2,513 members having been enrolled, 70 per cent of whom finished their work. It is noted that boys were interested in the bread clubs. Canning clubs and pig clubs enrolled 2,600 members. Calf clubs were a new project and were given considerable time.

What the agricultural extension service is doing for South Carolina, W. W. LONG ET AL. (*Clemson Agr. Col., S. C., Ext. Ann. Rpt., 1920, pp. 144, figs. 33*).—Six points in the policy of the extension service as outlined here include soil building through the use of legumes, cover crops, live stock, and crop rotation; seed selection; use of purebred sires; the growing of all food and feed crops on the farm; economic production for the market of crops and live stock promising greatest profit; and the study and encouragement of cooperative marketing associations for agricultural crops. The year's work is summarized by projects, and results largely in terms of persons reached and value of live stock and crops produced are reported. A list of county, home demonstration, and negro agents is included.

Tenth annual report of the eleven district agricultural schools of Georgia, J. S. STEWART (*Ga. Col. Agr. Bul. 189 (1919), pp. 32, fig. 1*).—This report contains information similar to that in the preceding (E. S. R., 41,

p. 391). A note on methods in carrying out supervised practice discusses the project plan and the problem of the boarding pupil. The group project, rather than that for the individual, is recommended for the boarding pupils in their supervised work in the winter garden and orchard during the school year.

The butter laboratory guide, E. S. GUTHRIE and H. C. JACKSON (*Ithaca, N. Y.: Comstock Pub. Co. [1919], pp. 65*).—Exercises are devised for use in elemetary laboratory instruction in connection with the textbook previously noted (E. S. R., 40, p. 283). It is recommended that small apparatus be used and that the class be divided into squads of two, each lesson requiring one long period of five hours each week.

The lessons deal with the operation of a separator and various factors influencing its efficiency, the ripening of the cream, and the underlying principles and technique of butter manufacture from churn to package.

Food and cookery and the care of the house, M. L. MATTHEWS (*Boston: Little, Brown & Co., 1921, pp. XVI+189, pl. 1, figs. 44*).—This textbook is intended for use in first lessons in elementary schools in the study of the selection and preparation of foods and the planning of meals from the nutritive, aesthetic, and economic standpoints. The recipes and exercises are arranged largely according to the meal plan throughout.

Lessons in cookery.—Book IV, Diet for invalids, F. E. STEWART (*Chicago: Rand McNally & Co., 1920, pp. VIII+176*).—This is the fourth volume of a series designed primarily for high-school students of home economics. It covers a semester's work, containing 40 cooking lessons, planned to occupy at least two 50-minute periods each week. The lessons are planned in seasonal sequence from February to June, based upon the foods in season.

The manual presents a consideration of simple, basic, dietetic principles and of typical recipes and menus that are suitable for invalids, but which may be used for the normal adult.

The school lunch, M. WHITTEMORE, D. SONNENDAY, and E. ENRIGHT (*Ky. Agr. Col. Ext. Circ. 95 (1921), pp. 32, figs. 6*).—This circular suggests ways and means useful in the one-room school undertaking to serve one hot dish for lunch. Indispensable supplies and equipment are described, and numerous recipes are given.

Sewing and textiles, M. L. MATTHEWS (*Boston: Little, Brown & Co., 1921, pp. XVI+155, pl. 1, figs. 60*).—First lessons for elementary schools in the selection of clothing and garment making, the hygiene of clothing, and the clothing budget are offered, attempting the correlation of home and school work. Material for the use of the project method is inserted.

Practical teaching of textiles in high schools, G. G. DENNY (*Jour. Home Econ., 13 (1921), No. 8, pp. 342–345*).—Three possible methods of approach or immediate and natural lines of study of the identification, purchase, use, and care of wool and other fabrics are outlined, the motive being the pupil's pride in her personal appearance and the furnishings of her own home, the teaching material, the fabrics in her own clothing, and the furnishings of her own room or one at the school.

The home laundry, F. ROSE (*Cornell Reading Course for the Home, No. 137 (1920), pp. 177–222, figs. 18*).—This manual sets forth fundamental principles and practical methods for laundering various fabrics and articles.

Suggestions for a program for health teaching in the elementary schools, J. M. ANDRESS and M. C. BRAGG (*U. S. Bur. Ed., Health Ed. No. 10 (1921), pp. 107, figs. 31*).—General suggestions are made relating to health education in every grade, as well as more specific ones, including an outline for nutrition classes by M. M. Smith (pp. 40–42), many illustrations of health

posters, and health songs to be used in appealing to children in the earlier grades. A briefly annotated list of reference books for teachers is given.

Design and improvement of school grounds, W. C. COKER and E. HOFFMANN (*N. C. Univ. Bur. Ext. Bul., Spec. Ser. No. 1 (1921), pp. 48, pls. 20, figs. 12*).—Simple principles of design and planting are set forth, and a list of ornamental trees, shrubs, and flowers that are considered suitable for various sections of North Carolina is given, together with a list of reference books and a number of plates and illustrative design of school grounds.

MISCELLANEOUS.

Annual report of the director for the fiscal year ending June 30, 1920, C. A. MCCUE ET AL. (*Delaware Sta. Bul. 126 (1920), pp. 28*).—This contains the organization list, a report of the director, including a financial statement for the fiscal year ended June 30, 1920, and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Director's report for 1920, W. H. JORDAN (*New York State Sta. Bul. 483 (1920), pp. 23*).—This contains the organization list and a review of the work and publications of the station during the year.

Report of Porto Rico Station, 1920, D. W. MAY ET AL. (*Porto Rico Sta. Rpt. 1920, pp. 39, pls. 6*).—This contains the organization list, a summary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, and reports of the chemist and assistant chemist, horticulturist, assistant horticulturist, entomologist, specialist in farm management, and agricultural technologist. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty years of agricultural experiments in Utah, F. S. HARRIS and N. I. BUTT (*Utah Sta. Circ. 46 (1921), pp. 64*).—This is a summary of the important findings of the station since its establishment, classified by subjects. A list of the station publications is appended.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 3 (1921), No. 4, pp. 115–148, figs. 11*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Farm Crops Experiments, 1921, by J. F. Cox; The Michigan Septic Tank, by F. E. Fogle; Potato Spraying, by H. C. Moore; The College Holstein-Friesian Herd, by J. E. Burnett; Milk as a Control of Intestinal Disorders, by R. L. Tweed; Summer Live-stock Management, by G. A. Brown; Available Nitrogen on Every Farm, by Z. N. Wyant; and Fruit Growers Help Plan Experiments, by T. A. Farrand.

Report on the work done during 1918, 1919, and 1920 [at Rothamsted Station] (*Rothamsted Expt. Sta., Harpenden, Rpt. 1918–1920, pp. 8–27*).—Results of analyses of expenditure per acre on different crops and cash returns, the value of the tractor, and investigations of the possibility of increasing the output from the soil as depending upon the application of artificial fertilizers, the amount of organic matter contained, and the physical conditions of the soil, as well as special entomological investigations and the war work at this station, are reported on in these pages.

NOTES.

Kentucky University and Station.—Miss Linda Purnell has resigned as assistant professor of home economics and W. C. Pierce as assistant chemist. L. A. Brown has been appointed head of the public service laboratories, with L. P. Benjamin as assistant bacteriologist and Chester G. Fuss and John Gaub as assistant chemists. Miss Nellie Gard has been appointed instructor in textiles and clothing and Miss Lily Kohl instructor in institutional management.

Missouri University and Station.—The first wing of the new home economics building has been completed at a cost of $100,000, with $25,000 additional for equipment.

During the year ended June 30 the station issued 15 bulletins, 6 research bulletins, 9 circulars, 1 department guide, 1 manual, and 2 reprints. These 34 publications had a total of 951 pages and their entire editions a total of 5,643,000 pages.

Organized tours planned and carried out by the farmers of four Missouri counties, Boone, Callaway, Cole, and Howard, have brought at least 2,000 farmers to examine the station work within the last two months. In a series of six meetings at outlying experimental fields results in soils and field crops were recenlty demonstrated to 1,100 farmers.

Using nearby community and county organizations as a basis, the department of rural life has undertaken extensive studies in rural sociology. E. L. Morgan, formerly of the Massachusetts College and more recently national director of rural service of the American National Red Cross, has been appointed in charge of this work.

F. L. Duley has been granted a year's leave of absence and will make special studies in soil acidity and plant nutrition at the Wisconsin Station.

New Jersey College and Stations.—The legislature has provided for the erection of a poultry building, the expansion of the agricultural library, the equipment of a laboratory for dairy chemistry and bacteriology, drainage of a portion of the dairy farm, installation of a water system at the horticultural farm, and the erection of a storage building and a work shop to cost $5,000 each. Increased appropriations have also been made for the maintenance of the long courses in agriculture, the maintenance and repair of agricultural buildings, experimental work in vegetable production, and the organization of poultry exhibits. A new study provided for is that of methods of sewage disposal.

Cornell University and Station.—Contracts have been let for the new dairy building to be erected at a cost of about $400,000. This will constitute the first unit of the $3,000,000 building program authorized by the State legislature, for which $500,000 in now available. It will consist of a three-story main building, 170 by 63 ft., with a one-story manufacturing wing 202 ft. long. Besides experimental work, provision has been made for class rooms, offices, laboratories, sterilizing and incubator rooms, a department library, and an exhibition room.

Because no appropriation was made for it by the legislature, the Cornell game farm in connection with the college and station has been discontinued.

The equipment and 176 acres of land are being kept intact, however, so that the operation of the farm may be assumed should an appropriation be forthcoming later.

The farm crops department has been discontinued. The vegetable gardening work has been reestablished as a department under H. C. Thompson, and the remaining activities merged with the departments of plant breeding and soil technology. The latter merger will constitute a new department of agronomy under Dr. T. L. Lyon.

Charles H. Royce, extension professor of animal husbandry since 1906, died August 5 as a result of injuries recived received in a fall from a silo on his farm July 11. He was a graduate of the college of agriculture in 1891, receiving the M. S. degree the following year. He was 55 years of age.

E. G. Montgomery, professor of agronomy, has been appointed Chief of the Foodstuffs Division of the U. S. Department of Commerce. Dr. G. F. Warren, head of the department of agricultural economics and farm management, has been granted leave of absence until February 1, 1922, to serve as consulting specialist to the Chief of the Bureau of Markets and Crop Estimates, U. S. Department of Agriculture.

New York State Station.—George A. Smith, for 24 years in charge of the dairy work, has tendered his resignation to take effect October 31, and will be succeeded by Arthur C. Dahlberg, formerly of the Minnesota, Wisconsin, and North Dakota Stations as associate in research (dairying). W. L. Kulp and J. D. Harlan, assistants in research in biochemistry and agronomy, have been granted a year's leave of absence to take up graduate work at Yale and Cornell Universities, respectively.

Pennsylvania College and Station.—A bequest of $10,000 from the estate of the late Prof. John Hamilton, associated with the college for 40 years, has been accepted by the trustees. Half of the income of this fund is to be used for the promotion of the moral welfare of the student body through such agencies as the student Y. M. C. A. and the purchase of books for the college library. The remaining half of the income is to revert to the principal until the sum of $100,000 has been reached.

Recent appointments include Miss Emma Francis as assistant professor and Miss Julia Outhouse as research fellow in chemical agriculture, and R. H. Olmstead as instructor in dairy husbandry extension.

Porto Rico Insular Station.—On recommendation of the director, the fertilizer control service, the plant inspection and quarantine, and the tick eradication campaign have been definitely classified as activities outside the station's province. A new fertilizer laboratory has been equipped in the laboratory building of the station.

F. S. Earle, expert in cane diseases, has resigned to accept a commercial position, and has been succeeded by Arthur Rosenfeld. Dr. E. E. Barker, chief agronomist, has also resigned. J. P. Griffith, formerly of the Porto Rico Federal Station, has been appointed horticulturist.

Virginia Truck Station.—J. W. Trotter, a 1921 graduate of Clemson College, has been appointed assistant horticulturist, beginning October 1.

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EXPERIMENT STATION RECORD.

VOL. 45. DECEMBER, 1921. No. 8.

The 1921 convention of the Association of Land Grant Colleges, from November 8 to 10, 1921, was the sixth of its thirty-five annual gatherings to be held on southern soil and the second to assemble in the city of New Orleans. The last previous meeting in the South had been in Atlanta in 1912. Before this there had been the Baton Rouge convention of 1906, an Atlanta meeting in 1902, the first New Orleans meeting in 1892, and the Knoxville meeting of 1889.

Striking evidence of how rapidly the association's personnel has been changing in recent years is afforded by a study of the registration of those in attendance at the various southern meetings. Of about one hundred delegates at Atlanta nine years before, only about twenty were registered at the 1921 meeting, and of these but four had attended the New Orleans meeting ten years earlier. The absence through death or withdrawal from the land-grant college ranks during the decade of such leaders as Presidents Stone of Indiana, Waters of Kansas, Snyder of Michigan, Ayres of Tennessee, and Thach of Alabama, and of Directors Jordan of New York, Thorne of Ohio, Woods of Maine, Wheeler of Rhode Island, and Armsby of Pennsylvania, to cite only a few of the outstanding figures, indicates how sweeping have been the changes wrought by time.

Despite the absence of many well known faces, the attendance at New Orleans was both large and representative. The registration of delegates and visitors exceeded two hundred and included every State of the Union. As at Springfield, last year, however, only about two-thirds of the institutions were represented by their presidents. This is a matter of special significance, since under the amended constitution it is these officers alone who may attend the sessions of the executive body, now the legislative branch of the association. This feature of the new plan was again the subject of criticism, and an amendment to the constitution was proposed for consideration in 1922 under which substitutes for the presidents in the executive body would be permitted.

In arranging the convention program, the three subdivisions of resident teaching, experiment station work, and extension work in agriculture were limited to a single half-day apiece, with three half-

day sessions for the section as a whole. Sectional meetings were scheduled for both Tuesday morning and afternoon, and by Thursday noon all proceedings save the final meeting of the executive body had been concluded. This arrangement avoided overlapping with the program of the American Country Life Association, which held its fourth annual conference from November 10 to 12, but seriously conflicted with the Tuesday sessions of the American Society of Agronomy, the Society for the Promotion of Agricultural Science, and the American Association for the Advancement of Agricultural Teaching. With a view to minimizing the various difficulties encountered, the section on agriculture recommended to the executive committee the beginning of future programs on Tuesday evening and continuance through Friday, with two sessions for each subdivision and three meetings for the section as a whole. It is evident that the whole matter of program arrangement is still in process of evolution.

As regards subject matter, the program bore many evidences of careful planning. It was a well balanced program as formulated, with no single topic of outstanding interest but with opportunity for the presentation of most of the wide range of interests with which the association is now concerned. For the most part, the sessions were generously attended, and interest was well sustained throughout.

Only three of the speakers invited from outside the association's membership to address the general sessions were able to be present. These were Hon. J. J. Tigert, recently appointed U. S. Commissioner of Education, who described in detail the work and difficulties of the Bureau of Education, Mr. C. E. Gunnels, assistant secretary of the American Farm Bureau Federation, who brought the greetings of the federation and bespoke its desire to cooperate with the association in the advancement of American agriculture, and Dr. A. E. Taylor of the new American Institute of Nutrition at Palo Alto, Calif. Dr. Taylor, as at Springfield, contributed a paper on the economics of the world's food supply, this year dealing with The World's Need of Russia. This need he maintained was less of its cereals and oil seeds, which could be produced in sufficient quantity elsewhere, than of its immense normal purchasing power in the European market.

The principal address of the final public session was given by President W. O. Thompson of Ohio State University upon the subject of The Land Grant Colleges and the Public Welfare. In this inspiring address Dr. Thompson took up the origin and development of these colleges, showing that they do not serve purely private interests, but that their whole motive is service for the public welfare. As the basis of all welfare must be truth, he showed that the experiment station as a seeker after truth is the foundation of our agricul-

tural program, and that the more adequate its development the surer is our progress. Likewise, the extension work is directly beneficial to the general welfare as contributing, like research and college teaching, to a widening of intelligence, sympathy, and ability. Even collegiate instruction, while immediately individualistic, has still the dominant motive of service to society as a whole.

President Thompson pleaded especially for a broad outlook on the part of those charged with the preparation of the agricultural leaders of the future, for, as he expressed it, "great leaders can not be made of men with small vision." The glory of education is in its public outlook and public vision, as opposed to the partisan's attitude.

A memorial tribute to President W. E. Stone, prominent in the association's councils for many years until his tragic death in July, was presented by Dr. A. C. True of the States Relations Service. The secretary was instructed to incorporate in the proceedings a brief statement regarding President Stone, and also of three other members who had died within the year. These were President C. C. Thach, Dr. H. P. Armsby, and Dean Catherine J. MacKay, pioneers respectively in the fields of land-grant college administration, research in animal nutrition, and home economics.

The executive body elected as the new officers of the association President T. D. Boyd of Louisiana as president and Dean A. A. Potter of Indiana as vice-president, and continued Dean J. L. Hills of Vermont as secretary-treasurer. President A. F. Woods of Maryland was elected to the executive committee to succeed President Stone. A complete list of the officers and committees may be found on page 800. The preference of the executive committee as to the place for the 1923 meeting was announced as in favor of Washington, D. C.

Perhaps the most noteworthy single feature of the convention was the prominence given to the needs of the experiment stations. This was exemplified by the presidential address of Dean H. L. Russell of Wisconsin, himself a station director, entitled The Agricultural Experiment Stations in Middle Life and After. This address was a vigorous discussion of the difficulties confronting these institutions to-day. Dean Russell pointed out that although the three lines of educational activity, teaching, research, and extension, "should be kept abreast of each other and not tandem," in late years the increasing demands for instruction and extension work had led to a comparative neglect of investigation. Lack of continuity in service he characterized as the fundamental defect in the station organization, and this he showed to be impossible of correction under the present well-nigh stationary conditions of financial support. "With the working power of the dollar at present reduced from a pre-war basis fully a third, if not more, and in comparison with the situation which obtained in 1906 even a still greater reduction, it is ob-

vious that the experiment station is going backward rather than forward in its facilities, while on all sides greater and greater demands are being made on it for additional service."

Dean Russell also referred to the need of scientific investigation of problems of distribution and for studies of the home as well as of the farm, but showed how even in the comparatively well-tilled field of production a more fundamental type of experimentation is now required. As remedies for some of the stations' difficulties, he advocated relieving them of control and regulatory activities and greater attention to securing proper publicity for their work through attractive publications and in similar ways. As he expressed it, "the fact that so much of station endeavor is done out of the limelight, that the work has not the natural contacts with the public as has either extension or teaching, makes it all the more necessary that station administrators should not lose sight of those proper means that are at hand for showing the public the results accomplished and their significance."

Further concrete evidence of the relatively impaired status of the experiment stations was presented in a paper before the station division by Dr. E. W. Allen of the Office of Experiment Stations, on The Position of the Experiment Station in the College of Agriculture. This paper was a frank exposition of existing conditions and tendencies of the system as a whole. Such developments were referred to as the decrease in the proportion of station employees free from teaching or other college duties from sixty per cent in 1914 to forty per cent in 1920, the shrinkage in the number of station directors whose office is uncombined with that of other positions from twenty-nine ten years ago to twenty-three at present, the relatively meager amount of financial relief thus far obtained for most of the stations, and the increasing tendency toward institutional stratification on a basis of subject matter and a general submergence of the stations' identity or individuality. The disadvantages resulting from such handicaps were discussed, and the conclusion was drawn that the station to-day "can not afford to occupy a secondary position or to be contingent on other branches of college activity. Every consideration merits placing it in position where it can determine its own ends and shape its means to those ends. As the most exacting of the various functions of the college and the one most fundamental to the success of all the branches, it needs to be free to carry out its purpose and it deserves to be an object of concern."

The broad relationships of agricultural research to the popular welfare were set forth in a stimulating address by Director Thatcher of the New York State Station, who referred to the unusually favorable outlook apparently confronting research in this country at the close of the World War, and the temporary thwarting of this distinct

impetus by the business depression and the popular demand for close restriction of expenditure of public funds. The return to more normal conditions he felt would bring increased support, although he made it clear that such support must be based on a real understanding and genuine appreciation of the part which research can play in the development of a sound national agricultural policy.

Director Thatcher went on to enumerate three general types of work as proper to be undertaken by an experiment station, all of which are capable of adding to our store of fundamental knowledge of agricultural science and practice. These are the endeavor to ascertain what are the scientific principles back of certain farm practices known to be correct because of their long continued use by successful farmers in many localities, the critical examination of other agricultural practices concerning which there is considerable doubt, such as the "sod mulch" in orchards, and the whole realm of new problems in the application of scientific principles to agricultural practice. He enumerated a long list of so-called "practical results" in which agricultural research had contributed materially to the economic prosperity of the nation, and argued that important contributions had also been made to its intellectual and social welfare.

This function was further elaborated by Dr. Allen in opening the discussion on the foregoing paper, when he pointed out that "it is through research that the colleges and the universities have been enabled to serve the public rather than the few—to extend their influence to every hamlet in the State and to every individual who will listen. It enables them to be truly democratic.

"The land grant college represented a breaking away from intellectual aristocracy in education, the opening up of the channels of knowledge to all the people. But without research this democracy could not have been obtained. These colleges, even though their doors were thrown open to all who came, must have remained more like the medieval institutions and the old style American colleges—for the select few and not for the whole public. The experiment stations were the agency which enabled the colleges to realize the high ideal which has made them such a mighty development in education. The position they have obtained as one of the most vital forces in human welfare is at once the triumph and the justification of research."

The fundamental indebtedness of agricultural practice to the experiment station was attested by Vice-Director W. F. Handschin of Illinois, in his paper entitled The Relation of an Extension Program to the Work of an Experiment Station. Prof. Handschin maintained that "in spite of the great value of the empirical knowledge gained through the centuries, most of the improved practices necessary to success in our modern agriculture are based very largely

either directly or indirectly on definite investigational work; and second, that a large proportion of the information resulting from our investigational work is already being used by the most progressive farmers in nearly every important farming region to which the information is applicable. . . . Except in the case of the most recent findings, not yet thoroughly tested under field conditions, the problem, from the standpoint of developing the extension program, seems to be concerned mainly with trying to extend into more general practice the improved methods already somewhat established on the farms of the best farmers in a large proportion of our farming communities."

Prof. Handschin's paper was in the main a plea for increased cooperation between the station as the production plant and the extension service as the machinery for marketing the product. The extension program, in his opinion, must rest fundamentally upon research. In the consideration and development of new projects for investigation the extension service may frequently be of great assistance in suggesting matters needing attention, keeping the station work informed regarding field experiences bearing on the project selected, and ultimately in testing out the findings on the basis of actual economic experience in the hands of the farmer.

An interesting plea for the extension of the activities of the stations to include studies of American farm population was presented by Dr. C. J. Galpin, economist in charge of rural life studies of this Department. Such studies he deemed permissible under the Hatch and Adams Acts, if so conducted as to "bear directly upon the agricultural industry of the United States," and he urged that opportunity be accorded them, since now "when the light shines with a fair ray over the physical mysteries, the farm population in comparison with plants and animals presents the unknown and mysterious elements in the agricultural situation." As a few of the "blind spots" he mentioned the lack of accurate knowledge as to the health and stability of farm population groups, migration from farm occupation and farm life, the types of population groups engaged in various kinds of agriculture, standards of a farm population as regards living, cultural, and political privileges, composition and characteristics as regards tenure, and the status of farm psychology and ideals. Studies of such matters he regarded as entirely feasible, either on a basis of surveys of population phenomena as presented in every-day life, or as in experimental situations with more or less artificially stimulated or controlled conditions. Instances of successful inquiries already prosecuted were cited, and means suggested for measuring results from definitely planned experiments.

In accordance with instructions given at the Springfield meeting, the report of the standing committee on experiment station organization and policy dealt with the paper submitted at that meeting by Dr. H. J. Webber, of California, entitled Problems of Agricultural Investigation. The committee gave careful and sympathetic consideration to the numerous important questions raised in Dr. Webber's paper, finding many of his suggestions worthy of strong commendation and others of extended study and reflection. Full accord was expressed with his contention that the station work should be at once both fundamental and practical, and the belief was expressed that with the right attitude and the wise guidance of directors there would rarely be evidence of what Dr. Webber referred to as a "conflict between what the experimenter desires to do and what the farmer requires to have done." His suggestion of an inventory of the agricultural problems of the State from time to time for the formulation of a general program was likewise approved, and much merit was seen in his advocacy of the organization of station investigation more largely around the problems to be solved.

Dr. Webber's proposed plan for a reorganization of the investigations of this Department and the State experiment stations under an arrangement whereby each station would become a State bureau of the Federal Department was closely analyzed. The committee reported that, in its opinion, "if the operation of the proposed plan would in any way tend to lessen the probability of the maintenance of the experiment stations as separate units of the land grant institutions, it would be a most undesirable step to take. The maintenance of the State stations as distinct entities, with their organization, staffs, and environment favorable to research of the highest possible type, is an indispensable consideration in all plans for the future development of the agricultural research possibilities of the country. The experiment stations which have been established as a result of the operation of the Hatch and Adams Acts constitute one of America's greatest contributions to agricultural organization, agricultural science, and agricultural progress, and their permanency should be carefully safeguarded in any plan for the future development of research in agriculture in the United States."

No report was made by the joint committee on projects and correlation, but the question of cooperative relationships was discussed by Mr. C. R. Ball, of the Bureau of Plant Industry, in an address on Federal and State Cooperation in Cereal Research. In this he described the cooperative work of the Office of Cereal Investigations, and presented a statement of principles which should underlie cooperative relationships. Discussion followed by several directors,

in which the practical results of such relationships in the respective States were narrated.

The joint committee on publication of research again called attention to the congestion of scientific journals and the *Journal of Agricultural Research*, announcing that the latter publication in spite of a return to a weekly issue now has sufficient manuscripts on hand to fill its columns until May, 1922. A recommendation from the committee that efforts be again made to obtain free reprints for authors and their institutions was adopted.

Special mention should be made of an interesting event not scheduled on the regular program, the assembling of the station directors for an informal dinner. Opportunity was thereby provided for making the acquaintance of the many new directors of the year and for emphasizing the idea of group solidarity and unity. In both respects the dinner proved thoroughly successful, and it was the general opinion that it was worthy of continuance as an accepted custom.

Scarcely less noteworthy than the association's attitude toward research was its continued interest in the economic and sociological phases of agriculture. A message from the Secretary of Agriculture announced that it had been his intention to make this subject the principal theme of his address, and there were plentiful evidences that the prevailing agricultural depression had intensified the growing realization of the opportunities and responsibilities of the land grant colleges for constructive service in this direction.

Reference has already been made to Dr. Galpin's paper advocating farm population studies, and to Dr. Taylor's address on Russia before the general session. The latter paper in particular brought out quite prominently the complexity of many of the economic problems, and illustrated the need of agencies of world-wide scope to aid in their solution. One such agency already existing is, of course, the International Institute of Agriculture at Rome, and a paper by Mr. L. M. Estabrook of this Department, before the section on agriculture, very appropriately served to direct attention anew to this institution and the valuable work it has under way as a world clearing house of agricultural information.

In response to action taken in 1920 requesting the Director of the States Relations Service to furnish annually such bibliographical statements dealing with agricultural matters as seemed to him pertinent, a selected list of references on rural economics and sociology prepared by Miss Martha L. Gericke was presented. This list gave a résumé of the progress made in developing the American literature since a previous report in 1913. Because of the large amount of material, it was found necessary to exclude the publications of this

Department, the experiment stations, the extension service, and the proceedings of most organized conferences and similar gatherings, yet 362 titles were included.

In the extension division there were two papers looking toward the formulation of an extension program respectively in rural economics and rural sociology. The first of these, by Dr. H. C. Taylor, Chief of the Bureau of Markets and Crop Estimates of this Department, dealt broadly with the opportunities for extension work open along National, State, and county lines in the field of rural economics. The second, by Dr. Dwight Sanderson of Cornell University, discussed ways in which a social environment conducive to the development of the best type of rural life may be fostered by extension workers. Projects in rural recreation, rural art, rural health, rural education, rural religion, and community organization were enumerated. The conclusion was drawn that "extension work in rural social organization should be not merely rural welfare work, but should seek to inculcate enlightened social attitudes among rural people with regard to the possibility and desirability of human progress; it should develop organizations which will be permanent because they are based upon sound policies and procedure; it should seek to give rural people exact knowledge concerning the conditions and processes of rural life and to arouse a controlling desire for the highest values in life. The extension specialist in this field should be at once a social evangelist and a clinical expert."

Still further opportunity for the consideration of problems along these lines was afforded in the sessions of the American Country Life Association, whose three-day program followed immediately upon the close of the Land Grant College Association convention and was attended by many of its delegates. The general subject of this conference was the relationships between the village or town and the outlying country. Trade, social, church, and school relationships were taken up in turn, both on the basis of actual accomplishments in specific communities and from the viewpoint of the association's fifteen committees.

The dominant questions as regards extension matters were those of organization and relationships with other agencies. The plans under consideration in this Department for its own extension forces were outlined by Assistant Secretary Pugsley. The new basis of organization following the consolidation on October 1 of the extension offices of the South and of the North and West was announced to be that in which the entire farm family is regarded as the unit, rather than the previous conception of distinct administrative divisions of extension work for the farmer, his wife, and his children.

This plan was subsequently endorsed in the paper by Mr. C. E. Gunnels already referred to.

An important report on the relationships between the extension and vocational educational forces in the various States was submitted by Dean A. R. Mann of Cornell University, as chairman of a committee of the association which has been meeting jointly with committees of the National Society for Vocational Education, the department of rural education of the National Education Association, the American Association for the Advancement of Agricultural Teaching, and the American Home Economics Association. This report interpreted the agreement of 1918 between this Department and the Federal Board for Vocational Education by further definitions, and it is believed will serve to clarify the situation by providing a basis for cooperative agreements in the several States on such matters as the junior project work of the schools and the junior extension (boys' and girls' club) work of the college of agriculture, the part-time and evening home making courses of the State bureaus of vocational education and the home economics extension work of the college, and short unit courses in agriculture and home economics in the schools and the extension classes of the college.

The report of the standing committee on extension organization and policy also dealt with several matters of relationships, such as those with the American Farm Bureau Federation. The holding of national and regional conferences of extension workers, the employment of subject matter specialists, and the status of farmers' meetings and institutes and of short courses at the college and extension schools were also discussed.

The topic of primary interest as regards resident instruction was again that of the improvement of the quality of instruction. The standing committee on instruction in agriculture, home economics, and mechanic arts presented a continuation of its Springfield report on the improvement of college teaching in vocational subjects. This report, based on a questionnaire sent out in 1920, dealt with difficulties in doing good teaching, opportunities afforded and means employed to improve teaching and keep up-to-date in vocational practice, the basis of promotion of teachers, and the relation of college teaching to research extension work and outside employment. Valuable data were assembled on all these matters and many constructive suggestions proffered. For instance, the lack of laboratory and reference equipment, more efficient assistants, and similar handicaps reported were recognized as too often real obstacles to good teaching, but it was suggested that in some cases these difficulties might be lessened by a broader and more adequate professional training. "Many of

the teachers of enduring reputation have done their work in small institutions with scant funds and meager equipment."

Considerable variation was found as to opportunities afforded teachers to improve their work. Ten out of the forty-two land grant colleges reporting are now granting sabbatical leave, and seventeen leave by special arrangement with or without pay, while at about nineteen per cent there are admittedly no opportunities for professional improvement. The committee concluded that fairly good use is made of such opportunities as are available, but suggested that college heads study their own facilities and formulate a definite policy of encouragement.

As regards the participation by teachers in other pursuits a moderate amount of research was generally favored, as was also the preparation of books, although it was quite generally believed that the criterion must be their contribution to teaching efficiency. The fundamental consideration in such matters was well summarized by the committee in its final conclusions as follows:

"Your committee believes that college is fortunate which is able to employ men and women who love the atmosphere and the work of college halls or shops or fields, and then is willing to let these men and women work themselves into the fabric of the institution, as woof or warp, in whatever capacities they can best work and best contribute to the advancement of knowledge and truth. If a faculty of such men and women are made financially comfortable and given such responsibility as they deserve in the shaping of policies in the college community, there will be little need to worry over division of time as between teaching, extension and research or devotion to duty as between college affairs and outside employments."

Another real contribution to the improvement of college teaching was made by Prof. T. H. Eaton, of Cornell University, who dealt with the matter largely from the viewpoints of pedagogics and psychology. Prof. Eaton pleaded especially for more clearly defined teaching objectives, a recognition of the limitations of subjects to provide so-called "mental discipline," more teaching through situations approximating those of the prospective life and occupations of the students dealt with, closer correlation and integration of courses now isolated, greater attention to individual differences in capacity to learn and in acquired experience, and the stimulation of increased activity and increased satisfaction in the learning processes on the part of the students. In order to achieve these ends he advocated the establishment of research studies by men competent in the fields of sociology, economics, and psychology to determine the specific objectives of teaching in the agricultural colleges, the review and assignment of such objectives by deans and similar officers to

appropriate departments within the college, the recruiting of as professionally qualified a teaching force as possible, especially in the initial courses, provision for vocational and educational guidance of beginning students, the rating of the improvement of students as to abstract, mechanical, and social intelligence, and the employment of a competent advisory consultant to the teaching force.

An account of the organization of resident educational courses by this Department, as recently noted, was given by Dr. E. D. Ball, Director of Scientific Work of the Department and in charge of this new undertaking. Considerable interest was shown in the project by those in attendance, and the opinion was expressed by a number of college deans that the innovation should do much to increase the desirability of Departmental service for the younger graduates, many of whom have been deterred from accepting appointments by the lack of provision of graduate instruction and credit. Dr. Ball made it plain that the Department's courses would in no sense duplicate work for which existing facilities were adequate, but expressed the hope that it would serve as a valuable supplementary agency for agricultural education in this country by providing courses not obtainable elsewhere.

The New Orleans convention may not rank in history as one of the most memorable gatherings of the association, but it was none the less an interesting occasion. The matters of business were numerous, but held little of the spectacular, and the work of the committees, while important, was more largely a continuation of lines previously mapped out than a venture into new fields. Many familiar faces of previous years were missing, and the association seemed to be passing through more or less of a transition stage as regards its leadership and policies. The convention showed itself open-minded in its attitude toward the newer opportunities for leadership along economic lines, and appreciative of the fundamental nature of research as the foundation of the whole land-grant college structure, though in neither direction did its sympathies crystallize into much formal action.

It was a notably harmonious convention, and made considerable progress in clearing up some perplexing difficulties as to relationships. Its program was well planned and varied, and it was effectively supplemented by the associated organizations meeting in connection with it. These taken together served to make a full week of much interest and value.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Beilstein's handbook of organic chemistry.—I, Principles for the systematic arrangement. Acyclic hydrocarbons, oxy- and oxo-compounds. II, Acyclic monobasic acids and polybasic acids, edited by B. PRAGER, P. JACOBSON, ET AL. (*Beilsteins Handbuch der Organischen Chemie. I, Leitsätze für die Systematische Anordnung. Acyclische Kohlenwasserstoffe, Oxy- und Oxo-Verbindungen. II, Acyclische Monocarbonsäuren und Polycarbonäsuren. Berlin: Julius Springer, 1918, 4. ed., vol. 1, pp. XXXV+983; 1920, 4. vol. 2, pp. VIII+920*).—In the preparation of the fourth edition of this well-known handbook the literature references have been extended to January 1, 1910. In addition to the two volumes noted here, it is stated that this edition will include two additional volumes on heterocyclic compounds and natural products which do not lend themselves to classification in any of the preceding volumes.

Casein viscosity studies, H. F. ZOLLER (*Jour. Gen. Physiol., 3 (1921), No. 5, pp. 635–651, figs. 5*).—This paper, which supplements the studies on technical casein previously reported from the Dairy Division, U. S. Department of Agriculture (E. S. R., 44, p. 808), deals with the viscosity-pH curves of casein in alkaline solution. The H-ion concentration was determined with the hydrogen electrode of the Clark rocking electrode type, and the viscosity measurements were made in a MacMichael viscosimeter slightly modified to provide accurate temperature control. The determinations reported include viscosity measurements of casein in various alkalis and in solutions of different salts, and the effect of hydrolysis and of varying temperatures on the viscosity.

It was found that the maximum viscosity of the casein occurred at about the same H-ion concentration (pH=9.1 to 9.25) with each of the bases used, NaOH, KOH, LiOH, and NH_4OH. The magnitude of viscosity was greatest in ammonia solutions.

The maximum viscosity occurred in the same region (pH=9.1 to 9.25) when casein was dissolved in Na_2CO_3, Na_3AsO_4, Na_2SO_3, NaF, and Na_2PO_3. In borax solutions the maximum viscosity occurred at pH=8.15 to 8.2. This abnormality is attributed to the influence of the polyhydroxyl groups of casein upon the dissociation of boric acid.

"The flattering of the viscosity curves of casein solutions, following the decline from maximum, is shown to be due to alkaline hydrolysis whence casein no longer exists as such but is cleaved into a major protein containing no phosphorus or sulphur and less nitrogen. This cleavage commences at pH=10.0 to 10.5.

"When casein is prepared from solutions that have been subjected to high temperatures (60° C. and above) or has otherwise been heated during its preparation, it yields solutions in alkalis of high viscosity."

The basic amino acids of glycinin, the globulin of the soy bean, Soja hispida, as determined by Van Slyke's method, D. B. JONES and H. C. WATERMAN (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 459–462*).—Glycinin pre-

pared from soy beans by the procedure of Osborne and Campbell (E. S. R., 10, p. 218) has been analyzed at the Bureau of Chemistry, U. S. Department of Agriculture, by the Van Slyke method with the following results: Amid N 12.19 per cent, humin N 0.97, arginin N 15.35, cystin N 0.80, histidin N 2.38, lysin N 10.27, amino N of filtrate 55.18, and nonamino N of filtrate 2.93 per cent. The distribution of the basic amino acids was as follows: Arginin 8.07 per cent, cystin 1.18, histidin 1.44, lysin 9.06, ammonia 2.28, and tryptophan 1.37 per cent.

Synthesis of inosit hexaphosphoric acid, S. POSTERNAK (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 453–457*).—A brief discussion covering the points noted in a previous paper (E. S. R., 45, p. 611).

The carbohydrate content of the navy bean, W. H. PETERSON and H. CHURCHILL (*Jour. Amer. Chem. Soc., 43 (1921), No. 5, pp. 1180–1185*).—The following data are given on the composition of a 1917 sample of navy bean: Moisture 12.96 per cent, ash 3.88, ether extract 1.83, protein 18.42, total sugar 1.59, starch 35.20, pentosans 8.37, galactans 1.33, dextrins 3.71, hemicelluloses 0.83, true cellulose 3.11, and organic acids, waxes, etc., by difference 8.77 per cent.

Another sample purchased two years later gave a much higher percentage of starch (50.5). Starch determinations on two varieties of peas, Alaska garden and Canada field peas, gave a yield of 51.21 and 45.11 per cent, respectively, thus showing that legume seeds are not only rich in protein but contain a large amount of starch.

The completeness of digestion of the starch of navy beans was greatly increased by fine grinding. The amount of starch obtained by digesting for 10 hours was but little greater than that after 4 hours.

The mineral constituents of potatoes and potato flour: Effect of process of manufacture on composition of the ash of potato flour, C. E. MANGELS (*Jour. Indus. and Engin. Chem., 13 (1921), No. 5, pp. 418, 419*).—Analyses are reported from the Bureau of Chemistry, U. S. Department of Agriculture, of the ash constituents of fresh potatoes and of potato flour prepared from the same lots of potatoes by the modern hot drum process in which the peel is partially removed by friction paring machines before the potatoes are cooked.

The data obtained showed that samples of fresh potatoes from different sources have varying amounts of ash constituents. Potato flour was found to contain a smaller relative amount of total ash and a very slightly smaller percentage of potash than the corresponding fresh potato, but the relative distribution of the different constituents of the ash was not appreciably different from that of the original potato.

Bacteriological and chemical studies of different kinds of silage, C. A. HUNTER (*Jour. Agr. Research [U. S.], 21 (1921), No. 10, pp. 767–789, figs. 6*).—This contribution from the Pennsylvania Experiment Station consists of an investigation of the nature of the fermentations in two silage mixtures—Canada field peas with oats and corn with soy beans, and a study of the relative importance of bacteria and enzyms in bringing about fermentations in silage.

The materials were ensiled both in ordinary concrete 8 by 30 ft. silos and in quart milk bottles stoppered with wired-in rubber stoppers and sealed with paraffin. Sampling from the regulation silo was done through pieces of 2-in. water pipes which had been placed in the walls of the silo during construction. The bacteriological examination included determinations of the total number of microorganisms, total acid producers, colon aerogenes group, bulgaricus organisms, yeasts, and protein digesters. The chemical studies included determinations of total and volatile acidity, amino, ammonia, albuminoid, and total nitrogen, and moisture. Three separate field experiments with the ordinary silo were conducted, using Canada field peas and oats in 1918, the same in 1919, and corn in comparison with corn and soy bean mixture, 1918.

From the bacteriological and chemical analyses little difference could be noted between the fermentations taking place in the different types of silage with the exception that there was a larger number of organisms belonging to the bulgaricus group in corn silage than in the other types.

To determine the relative importance of enzyms and bacteria in producing fermentation changes, a mixture of Canada field peas and oats was ensiled in quart bottles in three ways, untreated, treated with 2 per cent chloroform to inhibit the growth of organisms, and sterilized and inoculated with fresh silage juice to furnish a medium containing bacteria but no enzyms. Chemical analyses of the resulting silage indicated that the production of acids is due to microorganisms, the hydrolysis of protein with formation of amino nitrogen to plant enzyms, and the formation of ammonia to both enzyms and microorganisms.

Studies on enzym action.—XIX, The sucrolytic actions of bananas, K. G. Falk and G. McGuire (*Jour. Gen. Physiol., 3 (1921), No. 5, pp. 595–609, figs. 2*).—Continuing the studies on enzym action previously noted (E. S. R., 42, p. 502), an investigation is reported of the enzym action of bananas in various stages of ripening.

No conclusive evidence of the presence of an amylase could be obtained in any of the preparations. Sucrase was found in both a soluble and an insoluble form in growing and in ripe bananas. It was found possible to convert soluble sucrase into an active insoluble form by the addition of alcohol or acetone to the sucrase solution. The water or salt solution insoluble residue from ripe banana pulp possessed considerable sucrose-hydrolyzing action. On grinding bananas in a ball mill with toluene the proportion of soluble and insoluble sucrose gradually changed until after a week the soluble was practically all converted into the insoluble form. Both soluble and insoluble sucrase gave optimum action at approximately the same H-ion concentration (pH=4).

In discussing the conversion of starch into simple carbohydrates in the ripening banana, a change which would be considered to require amylase, two possibilities are suggested: (1) That amylase is present in the banana, but is rendered inactive in some way by the artificial treatment involved in grinding the material for extraction, or (2) that the ripening process or breaking down of the starch is not merely an amyloclastic action as this is commonly understood, but involves a simultaneous or preliminary oxidation reaction.

The effect of age on pancreatic enzyms, F. Fenger and M. Hull (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 431–435*).—A study of the deterioration of pancreatic enzyms on storing is reported. It was found that storing powdered pancreas preparations under ordinary conditions for a year reduced their diastatic and lipolytic activity, but had no effect upon their proteolytic activity. "This clearly indicates that trypsin, occurring both in the desiccated natural gland and in the activated preparations, is by far the most stable of the pancreatic enzyms."

A hydrogen electrode vessel adapted for titrations, A. B. Hastings (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 463–466, figs. 2*).—A hydrogen electrode apparatus adapted to measuring H-ion concentration and making electrometric titrations of small samples of material without the escape of gases or volatile matter is described and illustrated.

The electrode vessel consists of an upper stationary portion composed of a glass tube which carries by means of a rubber stopper the electrode, burette, and gas inlet and outlet tubes, and a lower rotating portion which contains the substance under examination, the two parts of the apparatus being joined by a mercury seal. The rotating portion is connected by a stopcock with a receptacle containing saturated KCl and which has an outlet to the calomel

electrode. The hydrogen electrode consists of a small platinum wire, one end of which is fused into a glass tube and the other to a paddle-shaped piece of platinum. The tube contains a little mercury into which dips a copper wire connected with a potentiometer.

A new method for the determination of potash, A. MARTELLI and L. EDLMANN (*Ann. R. Ist. Super. Forestale Naz. Firenze, 4 (1918–19), pp. 241–249*).—The method described is essentially the same as that suggested by Hicks and Bailey, as reported by Ashley (E. S. R., 38, p. 123).

A simple method for the direct quantitative determination of sodium in small amounts of serum, B. KRAMER and F. F. TISDALL (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 467–473*).—The method described, which is said to yield results practically identical with those obtained with the same reagents on ashed blood as previously noted (E. S. R., 42, p. 506), consists in adding to 2 cc. of the serum in a platinum dish 10 cc. of the potassium pyroantimonate reagent, followed by 3 cc. of 95 per cent alcohol added drop by drop with constant stirring. After standing 45 minutes the precipitate is transferred to a weighed Gooch crucible, washed with from 8 to 10 cc. of 30 per cent alcohol, and the crucible dried at 110° C. for one hour, cooled in a desiccator for 30 minutes, and weighed.

A new method for the determination of CO_2 in alkali bicarbonate in the presence of carbonate, W. HARTMANN (*Ztschr. Analyt. Chem., 59 (1920), No. 7, pp. 289–297, fig. 1; abs. in Analyst, 45 (1920), No. 537, p. 459*).—The method depends upon the fact that on heating with glycerin a salt containing both carbonate and bicarbonate, the CO_2 of the bicarbonate is driven off at from 112 to 118° C. and of the carbonate at 180 to 190°. The technique is as follows:

The substance, furnishing from 0.1 to 0.3 gm. bicarbonate, is placed in a tube 15 by 3 cm., closed with a 4-hole rubber stopper provided with a 200° thermometer, an inlet tube reaching to the bottom, and also a tap funnel and outlet tube. Air freed from CO_2 is drawn in succession through the tube, cooling bulbs, a wash bottle of strong H_2SO_4, a calcium chlorid tube, a weighed potash absorption apparatus, and a calcium chlorid tube. After adding through the tap funnel 7 cc. of 70 per cent glycerol for each 0.1 gm. of carbonate, the tube is heated for 10 minutes at 117° for sodium bicarbonate or 114° for potassium bicarbonate, and air is drawn through the apparatus for 30 minutes at 90 to 100°, after which the potash bulb is weighed. The temperature is then raised to from 180 to 190° for 5 minutes, 2 drops of water are added, and the heating continued for 5 minutes, when air is drawn through for 30 minutes at 150° and the potash bulb weighed as before. The method is said to be applicable to bicarbonates alone or in admixture with non-electrolytes.

The detection of phenols in water, R. D. SCOTT (*Jour. Indus. and Engin. Chem., 13 (1921), No. 5, p. 422*).—It has been found possible to detect the presence of small amounts of phenols in water by the Folin-Denis colorimetric test. The method as first applied to water examination by C. E. Trowbridge consisted in adding to 100 cc. of the sample 1 cc. of phenol reagent and 5 cc. of sodium carbonate. In numerous tests of the method by the author, it has been found that tannin in dilute solution also gives the test, but that on acidifying and distilling the sample before making the determination the test becomes specific for phenols.

The determination of the acetyl value of fats, É. ANDRÉ (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 16, pp. 984–986*).—The author has derived a formula by means of which the acetyl number of a fat can be calculated from the saponification number before and after acetylation. The formula is as follows:

$$A=S'-S\left(1+\frac{0.75\ S}{1-0.75\ S}\right)$$

where A=the acetyl number and S and S′, respectively, the index of saponification of the original fat and of the same fat after being acetylated. The derivation of the formula is given in full, and the results are reported of comparative determinations of the acetyl number of various oils by the new and old method. While the results of the new method are all slightly lower, they are thought to be more exact than those obtained by the regular method.

Nitrogen distribution of the proteins extracted by dilute alkali from pecans, peanuts, kafir, and alfalfa, C. T. Dowell and P. Menaul (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 437–441*).—This contribution from the Oklahoma Experiment Station includes data on the nitrogen distribution by the Van Slyke method of the proteins extracted by 0.2 per cent NaOH and 5 per cent Ba $(OH)_2$ from pecans, peanuts, kafir, and alfalfa. The authors are of the opinion that this method may be of value in determining the amino acid composition of foods and feeds. "We realize, however, that further work will have to be done before we can say definitely that the extraction of proteins by alkaline solutions will enable us to apply the Van Slyke method of analysis to all classes of foods and feed substances."

The determination of carbohydrates in vegetable foods, V. C. Myers and H. M. Croll (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 537–551*).—In the methods described for the determination of available carbohydrate in vegetable foods, the free soluble sugars are extracted with water from the ground vegetable and determined by reduction of sodium picrate to sodium picramate, both before and after hydrolysis of the nonreducing sugar with picric acid, as described in the paper by Rose noted on page 719.

In the determination of the total available carbohydrate, a preliminary hydrolysis of the starch in the material by taka-diastase is completed by gentle acid hydrolysis of the dextrins and maltose with approximately 0.6 N HCl for 1 or 2 hours in a water bath, and the reducing sugar is then determined by the reduction of sodium picrate. The technique of both methods is described, and results are reported of determinations of free soluble sugars on a variety of raw and cooked vegetables and fruits, and in some cases on the water drained from the vegetables after boiling. Determinations of the total available carbohydrate were also made on some of these vegetables.

The results obtained with regard to the proportion of soluble to total carbohydrates are similar to those reported by Falk (E. S. R., 42, p. 202). The percentage of starch was found to be low in fruits and many of the vegetables, but high in potatoes, peas, and lima beans. The data also showed that in cooking vegetables the greatest loss of carbohydrate occurs in those vegetables in which most of the carbohydrate is in a soluble form, and that the greater the proportion of water used in boiling the vegetable and the longer the time of boiling the greater is the loss of carbohydrate.

Alkalinity and phosphate determination in the ash of foods, J. Tillmans and A. Bohrmann (*Ztschr. Untersuch. Nahr. u. Genussmtl., 41 (1921), No. 1–2, pp. 1–17*).—Attention is called to the error in the ordinary methods of ash determination of food materials in not taking into account the phosphates which may be present, and a method of determining the alkalinity of the ash is described which makes allowance for this. The technique is briefly as follows:

The finely powdered ash is carefully dissolved in the cold in from 50 to 100 cc. of N/10 HCl, and after standing for 15 minutes is shaken with finely powdered sodium chlorid to saturation. To this solution is then added 30 cc. of a 40 per

cent calcium chlorid solution and 0.2 cc. of 1 per cent phenolphthalein, the mixture then being cooled to 14° C., and titrated with N/10 NaOH to a red color which persists after standing two hours at 14°. The difference between the amount of acid and base added is a measure of the alkalinity as carbonate and oxid.

For the ash determination of substances such as fruit juice in which a true alkalinity is present, the ash is treated with an excess of standard acid, transferred to a beaker, and heated to expel CO_2. It is then treated with 30 cc. of 40 per cent calcium chlorid and the determination finished as above.

For the determination of ortho-, pyro-, and metaphosphates, the first method described above is applied to a sample of the ash. In a second portion the pyro- and metaphosphates are changed to orthophosphate by long continued boiling with excess N/10 HCl, after which N/10 NaOH is added to the turning point of methyl orange, which gives all the phosphates as the primary salt. In order to titrate the solution with phenolphthalein to the end point for the secondary salt, the calcium ion is first precipitated by the addition of sodium oxalate. Examples are given of the application of this method to ash containing only the orthophosphate, to those containing a mixture of ortho and pyro, and to those containing a mixture of pyro and meta salts. The practical application of the method to the ash of food materials is illustrated by analyses of the ash of milk, flour, meat, fruit juices, and cocoa.

A new lead number determination in vanilla extracts, H. J. WICHMANN (*Jour. Indus. and Engin. Chem., 13 (1921), No. 5, pp. 414–418*).—A new method for determining the lead number of vanilla extracts, requiring no dealcoholization or long standing, has been developed at the Bureau of Chemistry, U. S. Department of Agriculture. The essential difference in technique as compared with the Official method is that the lead acetate solution is added directly to the diluted extract, which is then distilled. Under these conditions the precipitate is readily formed and can be filtered directly on cooling.

Determinations of the lead number of authentic and unadulterated commercial vanilla extracts by both methods gave results which were uniformly one-third higher by the new than by the Official method. Analyses of adulterated extracts showed that sugar, glycerol, and coumarin, in the quantities usually found in extracts, had no effect upon the lead number by either method, but that added vanillin is detected with greater sensitiveness by the new method. With vanillin-reinforced extracts a modified method is suggested in which the excess vanillin is extracted with ethyl ether and petroleum ether. With simple dilutions of the extract the new method was found to give results more nearly proportional to the degree of dilution than the old.

The action of Becquerel and Roentgen rays as well as ultraviolet light on the peroxidase and methylene blue formalin reductase reaction of cow's milk, H. REINLE (*Biochem. Ztschr., 115 (1921), No. 1–2, pp. 1–21, fig. 1*).—Becquerel and Roentgen rays were found to be without effect on this reaction of milk. Ultraviolet light from quartz mercury vapor lamps apparently had a quickening effect upon the reactions during the first 20 to 30 minutes, but this proved to be due to the heating action of the rays, the milk quickly rising to 25° C. Control tests in which the milk was kept at a low temperature gave negative results. An extensive list of literature references is appended.

Iron as a cause of a formalin diphenylamin reaction of milk, F. REISS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 41 (1921), No. 1–2, pp. 26–29*).—Attention is called to the fact that traces of iron in milk from rusty cans, etc., may give positive formalin and diphenylamin reactions even in the absence of hydrogen peroxid and nitrates, respectively. In applying these tests it is suggested that a separate test be made for iron with potassium ferrocyanid.

The inversion and determination of cane sugar, A. R. Rose (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 529–535*).—This paper reports the details of a method of determining sucrose by inversion with picric acid and the reducing sugars colorimetrically before and after reduction, together with the application of the method of picric acid inversion to polariscope determinations. The technique of the method has been previously noted from a preliminary report (E. S. R., 38, p. 507).

Grain determination in molasses, H. Kalshoven (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 24, pp. 937–951, fig. 1; also Meded. Proefsta. Java-Suikerindus., Chem. Ser. No. 3 (1920), pp. 15, fig. 1*).—A further discussion of the method of determining grain in molasses (E. S. R., 43, p. 508), with details regarding the technique.

Grain in molasses, W. D. Helderman and C. Sijlmans (*Arch. Suikerindus., Nederland. Indië, 29 (1921), No. 8, pp. 253–255; also Meded. Proefsta. Java-Suikerindus., Chem. Ser. No. 3 (1921), pp. 3*).—Examples are given of the application of Kalshoven's method of determining grain in molasses to samples with an unknown grain content, with very little grain, and with no grain. The results obtained are thought to indicate the reliability of the method.

Official methods adopted by the chemists committee and the rules committee of the Cotton Seed Crushers' Association of Georgia (*Ga. Cotton Seed Crushers' Assoc. Proc., 16 (1920), pp. 120–134*).—Methods are included for the analysis of cottonseed hulls, cake, and meal; crude cottonseed, peanut, coconut, and soy bean oils; refined oils; and soap stock and acidulated soap stock.

Sugar and sugars, J. J. Willaman (*Amer. Food Jour., 16 (1921), No. 5, pp. 14–18, figs. 7*).—A popular discussion of the various forms in which sugars occur and their commercial possibilities.

A method for the clarification and preservation of fruit juices, E. M. Chace (*Calif. Citrogr., 5 (1920), No. 8, pp. 264, 265, 267, figs. 2*).—To avoid loss of flavor in citrus fruit juices resulting from over or uneven heating, the author recommends the use of a continuous pasteurizer, a convenient type of which is described and illustrated. In the case of grapefruit the juice is first extracted by means of a fruit press from the fruit cut in halves or quarters, but not peeled or seeded. If much essential oil from the peel accompanies the juice, it should be removed by passing the juice through a centrifugal cream separator. The juice is then passed through the pasteurizer, which may be heated as high as 85° C. (185° F.) without harm if the time of heating is kept between 5 and 10 seconds. From the sterilizer the juice passes to sterile 5 to 10 gal. bottles, which are corked and kept in cold storage until all the sediment has deposited in the bottom of the bottle. The clear juice is then decanted, mixed in the cold with about 2 lbs. of kieselguhr per 100 gal., and filtered through an ordinary rack and plate press. The filtrates from the press can be resterilized directly or can first be mixed with the other fruit juices to improve the flavor. After the second sterilization the juice is run into sterile bottles, capped, and stored.

Heat penetration in canning with reference to microbial spoilage, Z. N. Wyant (*Canner, 52 (1921), No. 22, pp. 27–31*).—This general discussion of the effect of various factors upon heat penetration in canning is based upon literature which has been noted from the original sources.

Swells in canned goods, H. Serger (*Ztschr. Untersuch. Nahr. u. Genussmtl., 41 (1921), No. 3–4, pp. 49–68, figs. 6*).—This paper consists of descriptions of processes used in commercial canning, reports of the biological and chemical examination of swells, and a discussion of the causes of such spoilage. A num-

ber of ingenious devices for the examination of the cans are described and illustrated.

Proceedings of the second dehydration convention held under the auspices of the California Department of Agriculture at Fresno, Calif., November 10, 1920 (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 2, pp. 51–98, figs. 7*).—This report contains the following papers relating to dehydration: Rain Damage Insurance, by W. V. Cruess (pp. 58–66); Relation of Fruit By-products to Horticulture, by F. T. Swett (pp. 66–70); Comparison Between Sun-drying and Stack-drying, by F. E. Neer (pp. 70–72); Prevention and Control of Insects in Dried Fruits, by E. R. de Ong (pp. 72–74); Efficiency in Dehydration, by A. W. Christie (pp. 75–82); A Successful Cooperative Evaporating Plant, by B. J. Jones (pp. 82–85); Observations on the Evaporation of Pears, Prunes, and Figs, by W. V. Cruess (pp. 88–93); and Some Observations on the Dehydration of Apricots, Peaches, and Grapes, by A. W. Christie (pp. 94–96).

Review of the scientific works relative to perfumes and essential oils (*Sci. and Indus. Bul. Roure-Bertrand Fils, Grasse, 3. ser., No. 10 (1914–1919), pp. 5–142*).—A bibliographic review covering the period from April, 1914, to October, 1919.

Scientific and industrial bulletin of Roure-Bertrand Fils of Grasse (*Sci. and Indus. Bul. Roure-Bertrand Fils, Grasse, 4. ser., No. 1 (1920), pp. 143, pls. 10*).—The first part of this publication consists of a chemical study of the essential oil of cowslip, two oils from Algeria, the oil of rhododendron, etc., together with revised tables of the constants of the principal essential oils. This is followed by a brief survey of the industrial situation in regard to essential oils and perfumes in 1920, and a review of the literature of 1919.

Vegetable fats and oils.—Sunflower seed and oil—Madia or chili seed oil, M. Rindl (*So. African Jour. Indus., 3 (1920), No. 3, pp. 256–265*).—Continuing the series previously noted (E. S. R., 45, p. 665), data are given on the composition of sunflower seed and oil and Madia seed oil, together with miscellaneous information concerning these plants.

On the content of free fatty acids in palm oil, F. C. van Heurn (*Commun. Gen. Expt. Sta. Alg. Ver. Rubberplanters Oostkust Sumatra, Gen. Scr. No. 8, (1920), pp. 14–31, fig. 1*).—Conditions leading to a high content of free fatty acids in palm oil as usually manufactured are discussed, and suggestions are made for so improving conditions of picking the fruits and handling them before and after they reach the factory that a product of low acidity can be obtained.

The proposal for the organization of a factory for the manufacture of palm oil, F. C. van Heurn (*Meded. Alg. Proefsta. Alg. Ver. Rubbersplanters Oostkust Sumatra, Alg. Ser. No. 10 (1920), pp. 26, pls. 7*).—This is a description of a model factory for the manufacture of palm-seed oil, embodying the points discussed in the above paper.

Evolution of the industries which transform agricultural products, M. L. Lindet (*Evolution des Industries qui Transforment les Products Agricoles. Paris: Libr. Enseignement Tech., 1920, pp. 159*).—This is a brief historical treatment of the development in France of various agricultural industries.

METEOROLOGY.

Bioclimatic zones determined by meteorological data, A. D. Hopkins (*U. S. Mo. Weather Rev., 49 (1921), No. 5, pp. 299, 300*).—The zones proposed are as follows: I, Major Frigid Zone—Arctic, Antarctic, and Alpine, with Minor Frigid 1, 2, 3, and 4 from the poles and from higher to lower altitudes; II, Major Temperate Zone—south and north of and below Major Frigid I, with

Minor Temperate 1, 2, 3, 4 5, 6, and 7, south and north of and below Minor Frigid 4; III, Major Tropical Zone—south and north of and below Major Temperate II, with Minor Tropical 1, 2, 3, 4, south and north of and below Minor Temperate 7.

"The major zones of this classification are not different from those which have long been recognized, except that their poleward and equatorward limits do not follow the parallels of latitude even at sea level. The minor zones correspond in general to the minor temperature zones proposed by Dr. Merriam for North America."

The use of the thermal mean in identifying bioclimatic zones is explained.

Bioclimatic zones of the continents, with proposed designations and classification, A. D. HOPKINS (*Jour. Wash. Acad. Sci., 11 (1921), No. 10, pp. 227–229*).—This article gives the same information regarding designations and classification of bioclimatic zones as is given in the article noted above.

Bibliographic notes on the temperature charts of the United States, R. DEC. WARD (*U. S. Mo. Weather Rev., 49 (1921), No. 5, pp. 277–280*).—This is a bibliography of "all the charts to which the writer has, up to the present time, been able to gain access." There is also brief reference "to a few miscellaneous temperature charts of the United States, and to the standard world temperature charts which are necessary in making any comparative study of the temperature conditions of the United States in relation to those of other parts of the world."

Temperature survey of the Salt River Valley, Arizona, J. H. GORDON (*U. S. Mo. Weather Rev., 49 (1921), No. 5, pp. 271–274, 275, pl. 1, figs. 4*).—This article reports the results of an investigation begun in 1913 "to determine within what limits the foothill sections of the Salt River Valley in the vicinity of Phoenix were adapted to citrus culture. Later the scope of the investigation was broadened to include a study of winter temperature over the whole valley. Upon the basis of records kept at more than 40 stations in the area considered a temperature map was drawn showing the mean minimum temperatures for December and January; the average length of the growing season in the different sections of the valley was determined; a basis was established for forecasting minimum temperatures in the various sections as related to the temperatures expected at the Weather Bureau station in Phoenix. . . . Work during the winter of 1919–20 was directed almost exclusively to the study of temperature inversion as found over the valley, a cross section from the hills on the north down across the Salt River and up into the hills on the south affording an excellent opportunity for such a study."

A map is given which shows the mean minimum temperature for December and January throughout the valley. It is stated that "while citrus trees grow and there are a few small groves as low as the 34° line, on the map the citrus section of the valley lies above the 35° line, and the most desirable sections above the 36° line. The fact that the fruit is nearly always off the trees before the first frost and that the trees are in a semidormant condition through the winter season makes the danger of loss from low temperature, once the trees have made a good start, less than for citrus sections of California. Smudging and flooding as a protection against frost are confined almost exclusively to young groves and nurseries. In exceptional cases, where frost is expected and the fruit has not been gathered, picking is rushed all day and far into the night as damage to the fruit rather than to the trees is the danger."

The average length of the growing season at Phoenix is shown to be 288 days. It varies from a month more to a month less at other places in the valley.

Computing the cotton crop from weather records and ginning reports, J. B. KINCER (*U. S. Mo. Weather Rev., 49 (1921), No. 5, pp. 295–299, figs. 3*).—In this article the relation between rainy and cloudy days and the amount of cotton ginned during November is mathematically worked out for the whole cotton belt as a basis for forecasting the final output.

"The closeness of relation between the average number of rainy and cloudy days in the cotton belt and the percentage of the cotton remaining unginned on November 1 that was ginned during November, is shown by the correlation coefficient of -0.91 ± 0.03. This is among the highest coefficients on record where meteorological data are involved."

Computations based on ginning and meterological data for 15 years, 1905–1919, show an "average error in the computed totals for the 15-year period [of] only 1.5 per cent, with an error as great as 2 per cent in only 5 of the 15 years, while it was less than 0.5 per cent in one-third of the years. By the application of the constants of the equation to the November weather data in future years a reliable computation of the cotton crop can be made in less than five minutes after the amount of cotton ginned to December 1 is reported by the Bureau of the Census. The final report of yield is not made by that bureau until the latter part of March, or later."

Indicator precipitation stations for predicting stream discharge, H. L. STONER (*Abs. in U. S. Mo. Weather Rev., 49 (1921), No. 5, pp. 301–303, figs. 2*).—It is stated in this article that "three precipitation stations, widely separated and manned by cooperative weather observers, are utilized to predict the flood-time discharge of Bear River, a Utah-Wyoming-Idaho stream whose watershed covers 2,500 square miles. From precipitation data available at the end of January a prediction can be made, according to the author, as to whether the flood period of March–July will be high or low as compared with the average; at the end of February a verification or modification of the January prediction can be made; at the end of March an approximation of the quantity of the run-off in day second-feet may be ventured; and at the end of April a quantity estimate can be given which will no doubt closely approach the actual flood-period run-off. From a developed relation of flood and nonflood period run-off, it is also claimed to be possible to predict in advance the run-off during the nonflood period. Only quantity forecasts are attempted, no effort being made to state the form of run-off curve."

Speaking of the weather, J. W. SMITH (*U. S. Dept. Agr. Yearbook 1920, pp. 181–202, figs. 10*).—This is a brief popular account of the observations and investigations of the U. S. Weather Bureau mainly in the interest of agriculture.

Monthly Weather Review (*U. S. Mo. Weather Rev., 49 (1921), Nos. 5, pp. 271–326, pls. 13, figs. 19; 6, pp. 327–378, pls. 13, figs. 17*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for May and June, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 5.—Temperature Survey of the Salt River Valley, Arizona (illus.), by J. H. Gordon (see p. 721); The Cool Breeze of the Shadow of the Cumulus, by W. J. Humphreys; Bibliographic Notes on the Temperature Charts of the United States, by R. DeC. Ward (see p. 721); Level of Constant Air Density, by W. J. Humphreys; A Review of Some of the Literature on the Sunspot-Pressure Relations (illus.), by A. J. Henry; Vapor Pressure and Humidity Diagram (illus.), by R. E. Horton; A Psychrometric Chart for Determining the Dewpoint and Relative Humidity (illus.), by R. B. Smith; A New Correction-Scale for Mercurial Barometers (illus.), by S. P. Fergusson; Atmospheric Pressure and Mine

Gases, by J. C. Alter; Computing the Cotton Crop from Weather Records and Ginning Reports (illus.), by J. B. Kincer (see p. 722); Bioclimatic Zones Determined by Meteorological Data, by A. D. Hopkins (see p. 720); and Indicator Precipitation Stations for Predicting Stream Discharge (illus.), by H. L. Stoner (see p. 722).

No. 6.—Kona Storms (illus.), by L. H. Daingerfield; General Survey of Meteorological Problems of Pan-Pacific Countries, by L. H. Daingerfield; Droughts with Cirrus Clouds Moving from the North, by D. F. Manning, with a discussion on the subject by A. J. Henry; Illustration of Rainfall and Evaporation, Gatun Lake, Panama; Damage to Forests by Hail in North Carolina, by J. S. Holmes; Hailstorm Near Birmingham, Ala., May 11, 1921, by E. C. Horton; Hailstorm at Wausau, Wis., May 22, 1921, by E. F. Simes; Tropical Storm of June 22, 1921, by B. Bunnemeyer; Meterological Aspects of the National Balloon Race, 1921 (illus.), by C. G. Andrus; Effect of Change in the Position of the Thermometer Shelter at Escondido, Calif., upon the Minimum Temperature, by H. F. Alciatore; The Mass of the Atmosphere and of Each of Its More Important Constituents, by W. J. Humphreys; Altitudes of the Bases of Lower Clouds as Determined from Kite and Balloon Observations (illus.), by O. L. Lewis; The Argonne Battle Cloud, by B. M. Varney; and On the Differences between Summer Daytime and Nighttime Precipitation in the United States (illus.), by W. J. Humphreys.

SOILS—FERTILIZERS.

Uses of the Soil Survey, C. H. Seaton (*U. S. Dept. Agr. Yearbook 1920, pp. 413–419*).—A brief review is given of the conduct and results of the soil survey work of the Bureau of Soils.

A new soil sampler, B. H. Wilsdon and M. L. Mehta (*Agr. Jour. India, 16 (1921), No. 2, pp. 142–145, pls. 3*).—A soil sampler in use in India is described and diagrammatically illustrated. A weight is used at the top of the boring rod when difficulty is experienced in driving the auger through a very hard soil. A board is also used for deep borings, the object of which is to keep the direction of boring truly vertical. The board is pegged down by means of four large iron pegs, and the boring rod is inclosed by a bearing collar. The cutting tool is composed of a steel tube to which is riveted a knife edge bent into the shape of a V.

Soil survey of Iowa—Wayne County, W. H. Stevenson, P. E. Brown, et al. (*Iowa Sta. Soil Survey Rpt. 19 (1921), pp. 56, pl. 1, figs. 15*).—This deals with the soils of an area of 335,360 acres in central-southern Iowa, which lies in the southern Iowa loess soil area. The topography is in general a gently undulating plain cut by streams and drainage ways, and includes level to undulating uplands, flat bottom lands, and intervening areas. The drainage system of the county is in general rather extensively developed, with numerous intermittent drainage ways and small streams.

Drift and loess soils cover 45.6 and 47.1 per cent of the area, respectively. Six soil types of 4 series are mapped, of which the Shelby loam and Grundy silt loam cover 45.6 and 46.2 per cent of the area, respectively.

Chemical and fertility studies showed that practically all the soils of the county are acid in reaction, and are generally deficient in phosphorus and organic matter. It is noted that even on those soils which are not particularly deficient in organic matter, farm manure has proved profitable.

Soil survey of Cedar County, Iowa, A. M. O'Neal, jr., and D. S. Gray (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 35, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals

with the soils of an area of 364,800 acres in eastern Iowa, the topography of which comprises uplands, terraces, and first bottoms. Numerous small creeks and intermittent drainage ways ramify throughout all parts of the county, and are said to afford excellent drainage.

The soils are of loessial, glacial, and alluvial origin. Including meadow, 15 soil types of 11 series are mapped, of which the Muscatine, Tama, Clinton, and Carrington silt loams cover 29.8, 26.3, 24.2, and 10.8 per cent of the area, respectively.

Soil survey of St. Francois County, Mo., H. H. KRUSEKOPF ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 293,120 acres lying a little north of the southeastern corner of Missouri in the so-called Missouri Ozark region. The surface features vary from gently rolling to semimountainous, and the county includes three distinct physiographic divisions. The granite hills region in the southwestern part is semimountainous; the lowland basin in the eastern part is gently rolling; and the western and northern parts are hilly. The general drainage of the north half of the county is into the Meramec River and of the southern half into the St. Francois River and its tributaries.

The soils of the county are residual from limestone, sandstone, and granite. Including mine dumps and clay pits, 16 soil types of 10 series are mapped, of which the Clarksville, Lebanon, and Hagerstown silt loams and the Clarksville gravelly loam cover 20.4, 17.9, 13.1, and 12.6 per cent of the area, respectively.

Peat, H. PUCHNER (*Der Torf. Stuttgart: Ferdinand Enke, 1920, pp. XV+355, figs. 85*).—This book is apparently an attempt to summarize the German knowledge of peat and its uses. It is divided into two parts.

Part 1, on the scientific aspects of peat, deals with the peat-forming plants and their physical and chemical composition and properties, the transformation of plants into peat, the chemical composition and physical properties of peat, and methods for the chemical study of peat. In this connection peat is defined as a firmly stratified, yellow to brown and black-colored mixture of dead plant parts, the decomposition of which has proceeded very slowly owing to lack of ventilation and has never been completed.

Part 2, on the utilization of moors, deals with the agricultural development of peat soils and the winning and use of peat litter, but more especially with the use of peat as fuel and as a source of gas and other industrial products.

Soil acidity the resultant of chemical phenomena, H. A. NOYES (*Science, n. ser., 53 (1921), No. 1380, pp. 539, 540*).—The results of experiments conducted at the University of Pittsburgh are summarized, which showed that an alkaline sandy soil became acid in reaction after three months' treatment with carbon-dioxid gas and that the acidity of an acid brown silt loam was increased by similar treatment.

The acidity of the loam soil was decreased by liming, but not as much as the original lime-requirement determination indicated by the Veitch method. One and one-half times the total lime requirement did not neutralize the soil. Where the soil was limed, limed and phosphated, and limed and treated with dried blood or sodium nitrate, carbon-dioxid gas additions increased the soil acidity.

The specific conductivity of extracts obtained on treating the soils with conductivity water showed that carbon-dioxid gas had changed the constitution of the soil, the specific conductivity of those treated with carbon dioxid being greater. The acidity of the soils studied was lowered by extraction with conductivity water, and the lowering was greater for those samples which had been subjected to the carbon-dioxid treatment.

Further evidence that the acidity was due to chemical changes in the soil was given by the fact that the aluminum and iron in the normal potassium nitrate extracts were affected by the carbon-dioxid treatments. The composition of the conductivity extracts from the soils treated with carbon dioxid showed that the increased specific conductivity and acidity due to carbon-dioxid treatment were associated with substances with low solubility and ionization constants present under conditions where hydrolysis readily took place.

These results led to the conclusion that the soil acidity is the resultant of hydrolytic mass action phenomena, and, therefore, that the application of the exact amount of lime shown by any method can not be expected to give exact neutrality.

Investigations on chemical and bacteriological transformation in soil, F. MÜNTER (*Landw. Jahrb., 55 (1920), No. 1, pp. 62–138*).—Studies on the influence of pure fertilizer salts on transformations in soil indicated that monocalcium phosphate increases the solubility of silica, while neutral and basic lime salts decrease it. Phosphate and lime salts decrease the solubility of iron. If much iron is present, its solubility in more concentrated acid solvents is increased by the presence of lime.

All of the soils tested absorbed water-soluble lime salts. The absorbed lime content of compounds poor in lime was easily dissolved by ammonium chlorid solution or hydrochloric acid. Soils poor in lime and rich in silica were able to increase the solubility of tricalcium phosphate in ammonium chlorid solution. The solubility of calcium carbonate in ammonium chlorid solution was decreased by soils. In soil containing lime all of the lime added in neutral and basic lime salts was not recovered by treatment with cold 10 per cent hydrochloric acid. Potassium chlorid and sulphate and ammonium sulphate increased the water solubility of lime. Magnesia was found to be dissolved by an exchange of bases, and acid calcium phosphate increased its solubility in water and 10 per cent hydrochloric acid. Caustic lime decreased the solubility of soil phosphoric acid in 10 per cent hydrochloric acid in the presence of iron and alumina. Water-soluble phosphoric acid was fixed by lime, iron, and alumina.

Studies on the solubility of phosphoric acid indicated that the quantity of phosphoric acid available to plants is not determined by exchange of bases in soils or fertilizers. Cold ammonium oxalate dissolved considerable dicalcium phosphate, less tricalcium phosphate, and practically no tetracalcium phosphate. Magnesium sulphate and ammonium acetate had only a slight solvent effect on dicalcium phosphate and none on the more insoluble forms. A mixture of ammonium carbonate and acetic acid in equal parts and acetic acid alone attacked phosphates in a manner similar to that of many plants. Citric acid gave even better results, and these materials are considered to be relatively suitable for determining the availability of phosphates.

Pot experiments, to study the action of organic and inorganic nitrogenous fertilizers in different soils with varying moisture contents and to study nitrate formation, nitrogen losses, and the influence of organic carbon on nitrogen transformation in soils, are also reported. It was found that the heavier the soil the higher should be the moisture content in order to bring about uniformity in the decomposition of organic nitrogenous materials. The speed of ammonification and nitrification increased with lower moisture contents in the lighter soils. Nitrification occurred with low water contents in light soils, but with medium water contents it occurred in all soils. With the highest water content the highest nitrate content was found in sand soil after

a long period, since the nitrates formed in heavy soils had decomposed. With continuous high water content the loss of nitrates was 9 per cent from sand soils and 32 per cent from loam and clay soils.

Moisture content and soil type were found to exercise a great influence on the decomposition of ammonium sulphate and nitrate formation in soil, these increasing with the moisture content and the weight of the soil. The reverse was true with lower moisture contents, when ammonification and nitrification increased with the lightness of the soil. An addition of organic matter to soil hastened the decomposition of ammonia and reduced the nitrate content by fixation of the nitrogen in insoluble forms or, with high water content, as a result of losses of elementary nitrogen. The decomposition of nitrates in soil resulting from the addition of organic matter was increased by nitrate fertilization.

Studies on the transformation of nitrogen in sand soils and sand in the presence of zeolites showed that heavy clay soils decomposed ammonium sulphate much more rapidly than loess loam soils when plenty of moisture was present. The nitrification of ammonium sulphate was hindered by zeolites in sand soil with low moisture content, but liming favored nitrification. Ammonification and nitrification of horn meal were accelerated by the presence of zeolites although nitrification was hindered somewhat in the beginning by a low water content. Sand soil with zeolites behaved similarly to clay soil. Zeolites poor in lime and potash absorbed more ammonia nitrogen than saturated zeolites, and both accelerated nitrification.

Studies of the growth, activities, and nutrition of soil actinomycetes showed among other things that all of those types studied formed ammonia from organic matter. Exclusion of air hindered the growth of the organisms. Ammonium compounds were a good source of nutrition for actinomycetes. Nitrification took place to only a small degree. Nitrates were a good nutrient for actinomycetes, but apparently no reduction took place. There was no nitrogen fixation by actinomycetes observed in neutral, acid, or alkaline media.

Studies on chemical methods of ammonia determination in soils are also reported.

Studies on Azotobacter chroococcum, A. Bonazzi (*Jour. Bact., 6 (1921), No. 3, pp. 331–369, figs. 6*).—Studies conducted at the Ohio Experiment Station on Azotobacter are reported, from which it is concluded that the activity of Azotobacter as a fixer of atmospheric nitrogen in the field is not easily demonstrated. It is stated that actual gains due to this organism in the nitrogen contents of a soil in the field are seldom positively shown, although laboratory experiments made in selective media and in the absence of combined nitrogen would indicate the opposite.

It is pointed out, however, that soils are only exceptionally free of nitrates, and that these are easily washed away. The belief is expressed, therefore, that Azotobacter, instead of serving as an active gatherer of free nitrogen, may act to immobilize the nitrate nitrogen, taking the upper hand over denitrifying bacteria and to a considerable extent stopping leaching. While it is apparently not intended to convey the impression that the organism is lacking in all powers of nitrogen fixation, it is pointed out that this function is not to be considered as an all-important phenomenon always active.

Fire fang of soils, R. Perotti (*Atti. R. Accad. Lincei, 5. ser. Rend. Cl. Sci. Fis., Mat. e. Nat., 28 (1919), II, No. 9, pp. 288–292; abs. in Abs. Bact., 4 (1920), No. 4, p. 237*).—Studies of samples of soil from an estate showed that when sown to wheat there was only a meager grain production, which was accompanied by an underdevelopment of the whole plant and a very luxurious vegetation of fungal mycelium on the roots.

Studies on the ammonifying, nitrifying, denitrifying, and nitrogen-fixing powers of these soils and counts of the bacteria and fungus flora led to the conclusion that the cause of the special condition of the soil and of its low productivity is not a lack of biological means for the transformation of nitrogen, but the overcrowding of the soil by hyphomycetes with the subsequent accumulation of the products of their life activities.

The increase of crop yields by proper soil disinfection, M. POPP (*Landw. Jahrb., 55 (1921), No. 4–5, pp. 549–579*).—Studies are reported which showed that soil bacteria exercise an important influence upon the productivity of cultivated soils.

It was found that the activity of soil organisms can be favorably influenced by chemical disinfection of the soil. This favorable influence is enhanced by the presence of humus, and neutral humus material added to the soil produced the same effect.

Humus carbolineum proved to be an especially effective soil disinfectant when used under favorable climatic conditions. It also appears to be a widely applicable material for the protection of plants against diseases and insects. The addition of humus carbolineum to lime nitrogen reduced the dusty condition of the latter, and retarded decomposition and hardening without injuring the fertilizing properties of the lime nitrogen.

The 1920 wheat, oats, and corn yields from soil experiment fields in Illinois (*Illinois Sta. Circ. 246 (1921), pp. 4*).—Tabulated data are presented giving the detailed results from a large number of the Illinois soil experiment fields through the season of 1920. These results are said to confirm those of previous years, and to demonstrate the possibility of improving the yields of important crops by systematic soil treatments which consider both profitable production and permanent agriculture. A more complete report of the experiments conducted on these fields through 1917 is contained in Bulletin 219 (E. S. R., 41, p. 218).

More efficient use of farm manure, H. DORSEY, B. G. SOUTHWICK, and P. A. CAMPBELL (*Conn. Agr. Col. Ext. Bul. 29 (1921), pp. 14*).—This report is based on the results of a so-called fertility school conducted at the Rhode Island Experiment Station by extension specialists and county agents from Rhode Island, Massachusetts, and Connecticut.

The object of this school was to give the extension workers an opportunity to study soil fertility problems, using the investigational work of the station as a source of information. A number of tables of data from the work at the Rhode Island and other stations are summarized, showing that from the plant food material standpoint the manures of farm animals are valuable in the following order: Hen, sheep, horse, cow, and pig. Bedding is considered to be a valuable part of manure, both for the plant food material and the organic matter it contains. Summer exposure has been found to cause greater losses from manure than winter exposure, and stall manure has produced larger crops than yard manure. Greater returns per ton of manure have been obtained from small applications, and it is stated that in many cases it pays to spread manure thinly. Manure has in general been found to increase crop yields, but these yields have been further profitably increased by reinforcing the manure with acid phosphate.

Washing out of nitrogen from ammonium sulphate by heavy rainfall before and after nitrification, C. H. VAN HARREVELD-LAKO (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 31, pp. 1313–1332, figs. 8; also Meded. Proefsta. Java-Suikerindus. Landbouwk. Ser., No. 7 (1920), pp. 20, figs. 8*).—Experiments are reported which showed that when heavy clay soils, after fertilization with

ammonium sulphate, were washed vigorously with water, only 13 per cent of the ammonia present was lost in the water.

After six weeks' nitrification one soil contained 10 per cent and the other 47 per cent of the added ammonia nitrogen. When ammonia was applied to one soil six weeks and to the other one week before flooding, a part of the nitrogen of the first application was taken up as nitrate by the cane roots and another part remained as soluble nitrate, capable of being washed out of the soil. Also a part of this application and the greater part of that applied to the second soil remained in the soil as ammonia nitrogen, only a small percentage of which was capable of being washed out.

It is concluded, therefore, that the poor growth of cane on such soils following heavy rains can not be made good again by a new application of nitrogen. The sum of the ammonia and nitrate nitrogen present in the soils was a little higher at the beginning of nitrification than before, which is attributed to the probable presence of insoluble nitrogenous compounds which had become soluble. At the end of the experiment this sum was smaller than at the beginning, this being deemed due probably to fixation by soil organisms.

Phosphates for Kentucky soils, R. E. STEPHENSON (*Ky. Agr. Col. Ext. Circ. 97 (1921), pp. 12*).—The results of experimental work conducted by the Kentucky Experiment Station on the use of phosphates on typical Kentucky soils are summarized and interpreted for practical use.

Data from six experimental fields, representing six different types of soil, showed that rock phosphate gave an average net return of $3.01 per acre per year for all crops as compared with $1.91 for acid phosphate. On the same basis lime and rock phosphate gave a net return of $8.08 per acre per year as compared with $11.12 for lime and acid phosphate. Wherever lime was used with the phosphates there was a profitable return, although in some cases the returns were greater from rock phosphate when lime was not used.

A comparison of rock phosphate and acid phosphate on unlimed soil showed that the rock phosphate gave the best results in all cases except one. When limestone was used with the phosphate treatments the results were reversed. The use of rock phosphate is apparently favored for these soils.

Directions for the practical use of phosphates are included.

Phosphorus in fertilizer, W. H. WAGGAMAN (*U. S. Dept. Agr. Yearbook 1920, pp. 217–224, figs. 3*).—Attention is briefly drawn in this paper to the wasteful methods practiced in the phosphate industry, and brief reference is made to new and more scientific methods of manufacturing acid phosphate which are being developed by the Bureau of Soils.

The reversion of water-soluble phosphoric acid in superphosphate, B. NEUMANN and K. KLEYLEIN (*Ztschr. Angew. Chem., 34 (1921), No. 18, Aufsatz., pp. 77–80; 19, pp. 84–86*).—Laboratory experiments with technically prepared materials are reported, which showed that one molecule of tricalcium phosphate reacts with two molecules of sulphuric acid, and that under these conditions at the most 95 per cent of the phosphoric acid in raw phosphate is transformed into monocalcium phosphate, while 0.54 per cent goes over into citrate-soluble form and 4.4 per cent remains unchanged as tricalcium phosphate. The use of an excess of acid apparently makes the transformation somewhat more complete, but at least 2 per cent of the tricalcium phosphate always remains unchanged.

The reaction products gypsum and phosphoric acid apparently do not react, but gypsum reacts with monocalcium phosphate, thus hindering complete transformation. Tricalcium phosphate also acts on monocalcium phosphate, resulting in apparent reversion. However, reversion of the water-soluble phosphate

is attributed mainly to the oxids of iron and aluminum in the raw materials. It is pointed out in this connection that the sulphates of iron and aluminum show practically no reaction with monocalcium phosphate, but that undecomposed iron and aluminum oxids react quickly with monocalcium phosphate and free phosphoric acid, causing rapid reversion to insoluble forms.

The yield of water-soluble phosphoric acid from raw phosphates containing up to 2 per cent of iron oxid is therefore less than from raw phosphates containing no iron. However, by the use of an excess of sulphuric acid the greater part of the iron is combined as sulphate and is rendered less harmful. The yield of water-soluble phosphoric acid decreases as the content of iron oxid in the raw phosphate increases, and the use of additional excess acid is of little benefit. The aluminum compounds are apparently considered to be of little importance.

It is concluded that the best method of reducing the injurious influence of iron oxid in the raw phosphate is to keep the iron oxid content below 2 per cent by mixing with raw phosphate poor in iron oxid.

The phosphates of Nauru and Ocean Islands, T. Steel (*Jour. Soc. Chem. Indus., 40 (1921), No. 6, pp. 59T, 60T*).—Analyses of 16 samples of rock phosphates from Nauru and Ocean Islands are reported and discussed.

Only traces of iron or alumina were present in any of the samples. Varying small amounts of fluorin occurred in many cases. The original source of phosphoric acid is conceded to be the accumulations of guano. Most of the samples bore evidence of having undergone considerable metamorphosis and of having been deposited either from solution or as sediment. The analyses indicated that only part of the phosphoric acid content is present as calcium phosphate, the relative proportions of constituents showing the presence of a varying proportion of tetracalcium phosphate.

Getting our potash, W. H. Ross (*U. S. Dept. Agr. Yearbook 1920, pp. 363–376, figs. 5*).—This is a brief review of the potash situation in the United States, special attention being drawn to the existing sources and methods of separation practiced. It is stated that during the past six years a total of 177,000 tons of potash has been produced in the United States, of which 10 per cent was obtained from insoluble potash deposits, 70 per cent from soluble deposits, and 20 per cent from organic materials.

The fertilizing action of sulphur (*Compt. Rend. Acad. Agr. France, 7 (1921), No. 21, pp. 492, 493*).—The results of several years of study of the fertilizing action of sulphur, conducted by J. Chauzit, are summarized. These indicate that sulphur has a distinct action on cultivated soil, which was shown in an increase in crops varying according to the amount of organic matter existing in the soil, the extent of the surface of contact, and the length of time of contact. This action was proportional to the quantity of sulphur used, which for economical and practical results varied between 400 and 600 kg. per hectare (356 and 534 lbs. per acre).

It is concluded that sulphur should be applied as long a time as possible before planting, or before the crop experiences an intense lack of nutritive elements. When applied in the fall with manure, 200 kg. of sulphur per hectare is said to give appreciable results. It has been found that sulphur increases the crop yields, improves the general condition of crops, promotes resistance to drought, retards certain plant diseases, and renders the nutritive material of certain organic and mineral matters available.

The fertilizer situation (*U. S. Senate, 66. Cong., 3. Sess., Doc. 410 (1921), pp. 27*).—This document consists of a letter from the Secretary of Agriculture, transmitting a statement on the fertilizer situation in the United States, in

response to a Senate resolution of January 26, 1921. Data are included on the amount of commercial potash, nitrogen, and phosphoric acid available for fertilizer purposes and the price of each of these articles as compared with the prices for 1913.

It appears from the data available that the total amount of actual potash imported or produced in the United States in 1920 was approximately the same as in 1913, the actual figures being 240,000 tons in 1920 and 237,437 tons in 1913. In 1920 there were imported 1,480,503 short tons of sodium nitrate as compared to a total of 659,600 short tons imported in 1913. The opinion is expressed that in view of the subnormal buying power for the spring season of 1921 the stocks on hand were sufficient for deliveries and contracts for the entire year of 1921.

It is estimated that about 490,000 tons of ammonium sulphate were produced in this country in 1920, and that considering imports and exports there were about 50,000 tons in the hands of the producers, and about an equal amount of contract material in the hands of the fertilizing manufacturers. The domestic consumption of ammonium sulphate, including domestic production and imports in 1913, is estimated as 260,775 short tons.

A probable production of about 70,000 tons of fish scrap in 1920 is estimated as compared with the 1913 production of 68,705 tons. The amount of cottonseed meal produced in 1920 is estimated to be around 2,288,000 tons, while the amount produced in 1913 was estimated at 2,220,000 tons. It is estimated that in the period from July 1, 1917, to June 30, 1918, about 34.9 per cent of the total tonnage of cottonseed meal and cake produced in the United States was used for fertilizer. No figures were available for the production of animal tankage, dried blood, and similar slaughterhouse products in 1920.

The data available indicate that the production of acid phosphate in 1920 was around 4,500,000 tons as compared to approximately 4,000,000 tons produced in 1913.

The data on prices of fertilizer materials in 1920, as compared with 1913, show that the prices for 1920 were in all cases higher than for 1913. In some cases, notably phosphates and potash, the prices were much higher, but in other cases only slightly so. Suggestions are given for relief of the situation in case the amount of any or all of the materials discussed is insufficient or the price prohibitive.

Analyses of fertilizers, fall season, 1920, W. G. Haywood (*N. C. Dept. Agr. Bul., 1921, Apr., pp. 11*).—This bulletin presents the results of actual and guarantied analyses and relative valuations of 205 samples of fertilizers and fertilizer materials collected for inspection in North Carolina during 1920.

AGRICULTURAL BOTANY.

Flowering and fruiting of plants as controlled by the length of day, W. W. Garner and H. A. Allard (*U. S. Dept. Agr. Yearbook 1920, pp. 377–400, figs. 9*).—A popular account is given of the effect of shortening or prolonging the period of daylight on flowering and fruiting of a number of different species of plants. A more technical account of this investigation has already been noted (E. S. R., 42, p. 818).

The water balance of the plant and its significance in crop production, T. G. Mason (*West Indian Bul., 18 (1921), No. 4, pp. 157–184; noted in Agr. News [Barbodos], 20 (1921), No. 500, p. 195*).—Accepting as fundamental the cohesion theory regarding the ascent of water in plants, the author considers in detail various known or supposed facts and factors germane to water balance in plants in relation to crop production.

Methods employed or desirable in the cultivation of crops to limit the diurnal fluctuations in the water content of the plant are considered. These involve the stabilization of tensions in the water contained in the body of the plant, and require consideration of both aerial and subterranean environment. Diurnal fluctuations in the desiccating influence of the air constitute a primary factor. Artificial reduction of transpiration during hours of sunshine and augmentation of the nocturnal transpiration rate are both considered.

The plant's water supply (*Agr. News* [*Barbados*], *20* (*1921*), *No. 500, p. 195*).—This is a brief presentation of that portion of the paper above noted which deals with the question of water balance as regards its economic significance.

Influence of nutrition and of root activity in connection with collapse and dryness following refrigeration, E. PANTANELLI (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29* (*1920*), *I, No. 1–2, pp. 66–71*).—Having shown in work previously noted (E. S. R., 43, p. 226) that generally in succulent parts of plants, particularly leaves, severe refrigeration is followed by injection of intercellular spaces with water given up by the cells, which lose turgor and contract so as to cause flaccidity in the plant, the author has followed up this work with studies on the chick-pea and bean, which are said to show the most diverse degrees of resistance to cold.

Employing methods indicated, the author has been able to show that the injury to individual cells exposed to low temperatures is proportional directly to the water loss during refrigeration. Abundance of sugars and other carbohydrates, adequate phosphate nutrition, and scarcity of autodigestive enzyms confer upon the plasma the quality or faculty to hold water more tenaciously. There appears to occur later a degree of progressive denaturization of the plasma, which tends to coagulate, losing finally the capacity to reacquire water. The degree of restoration of water to organs collapsed as a result of refrigeration is limited by the degree of collapse and the availability of water as furnished by the root system.

In a second series of experiments dealing with the influence of soil humidity upon resistance to cold, it was found that aerial organs usually suffered from cold somewhat proportionately to their water content. Modifying influences are mentioned.

These experiments showed root activity to be of great importance in resistance to cold.

Thermotropism in plants, R. COLLANDER (*Öfvers. Finska Vetensk. Soc. Förhandl., 61* (*1918–19*), *Afd. A, No. 2, Art. 11, pp. 95, figs. 8*).—Studies regarding thermotropism are described as carried out with sprouted Avena, Zea, Helianthus, Lepidium, and Vicia, also with *Linum usitatissimum*, *Phycomyces nitens*, and various roots. The findings are given in detail.

Another high temperature record for growth and endurance, D. T. MACDOUGAL and E. B. WORKING (*Science, n. ser., 54* (*1921*), *No. 1390, pp. 152, 153*).—In a previous publication (E. S. R., 45, p. 526) a report was given of joints of Opuntia continuing to grow at a temperature of 55° C. (131° F.). Subsequent measurements on other individuals were made, and a new high temperature record for active protoplasm in higher plants has been established. Joints of Opuntia were observed to maintain a fair rate of enlargement at a temperature of 56.5°, the surrounding air at that time being 58°. The growth of the young joints stopped at 62° and some shrinkage ensued, but growth was resumed when the temperature fell to 50°.

Supposed parthenocarpelly in hazelnut, I, II, A. TROTTER (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Fis., Mat. e Nat., 28* (*1919*), *II, No. 12, pp. 505–508, fig. 1; 29* (*1920*), *I, No. 1–2, pp. 72–76, figs. 3*).—Important losses to nut

growers in the Campagna have occurred recently, owing to the failure of many nuts to develop. The author has given attention to this and related phenomena since about 1904 (E. S. R., 17, p. 573), employing more recently special methods which are briefly indicated. It is thought that parthenocarpelly is excluded by the evidence as discussed, and that this trouble is due to a form of reproductive degeneration comparable to that causing abortion in animals.

Root development in the grassland formation: A correlation of the root systems of native vegetation and crop plants, J. E. WEAVER (*Carnegie Inst. Wash. Pub. 292 (1920), pp. 151, pls. 26, figs. 38*).—This study is in part a continuation of the investigations previously noted (E. S. R., 44, p. 220), but also includes an investigation of the root development of crop plants.

Grassland formation has been differentiated into several associations, of which three are considered here, true prairie, short-grass plains, and mixed prairie.

The biochemistry of carbohydrate production in the higher plants from the point of view of systematic relationship, F. F. BLACKMAN (*New Phytol., 20 (1921), No. 1, pp. 2–9*).—The object of this discussion is to review some of the biochemical diversities of carbohydrate production considered as steps toward a biochemical classification of plants, and to compare such diverse characters with the morphological characters on the basis of which groupings have been made of the flowering plants.

Suberin and cutin, J. H. PRIESTLEY (*New Phytol., 20 (1921), No. 1, pp. 17–29*).—This is an exposition of information which became available in a study of the physiological rôle of the epidermis, differences between suberin and cutin, varieties of each observed in different plants, and the conditions leading to observed variations in each of those substances.

The nutritional physiology of some fungi, F. BOAS (*Ann. Mycol., 16 (1918), No. 3–6, pp. 229–239*).—This article deals with nutrition values in some nutrients and with autotoxins in Cladosporium and other fungi.

Carbon dioxid assimilation by Neottia, F. WEBER (*Ber. Deut. Bot. Gesell., 38 (1920), No. 6, pp. 233–242*).—Citing previous attempts to establish conclusively the assimilation of carbon dioxid by the bird-nest orchid (*N. nidus-avis*), the author describes his own experimentation with this orchid. He states that in darkness the plant made no growth and remained colorless. Starch associated with the chromatophores did not disappear when kept in darkness during one to many days, and even appeared to form in darkness. Points are noted of the likeness in behavior between Neottia and certain of the brown algae.

Some cases of mycorrhizal relation between Boletinae and woody substances, B. PEYRONEL (*Staz. Sper. Agr. Ital., 53 (1920), No. 1–3, pp. 24–31*).—Notes are given regarding extension of observations previously noted (E. S. R., 37, p. 727).

Morphological and physiological analysis of plant and animal cells, A. MEYER (*Morphologische und Physiologische Analyse der Zelle der Pflanzen und Tiere. I, Allgemeine Morphologie des Protoplasten. Ergastische Gebilde. Zytoplasma. Jena: Gustav Fischer, 1920, pt. 1, pp. XX+629, figs. 205*).—This is a systematic account of the plant or animal cell, with an extensive bibliography.

The fibrillar structures of Nemec, V. BAMBACIONI (*Atti R. Accad. Naz. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29 (1920), II, No. 1–2, p. 62–65*).—Having studied the structures and phenomena described with interpretation by Nemec (E. S. R., 13, p. 715), the author states that while he was not able to find such structures in most parts of apical root cells, he did find in *Aspidium aculeatum* a structure comparable to that described by Nemec. He thinks, however, that these are accounted for by the presence of chondriosomes having

various forms which do not appear to present the behavior attributed to them by Nemec.

Sensitivity and permeability of plant protoplasts in relation with acids and bases, W. Brenner (*Öfvers. Finska Vetensk. Soc. Förhandl., 60 (1917–18), Afd. A, Art. 4, pp. 124, figs. 4*).—An account is given of studies employing different plants and other material, and showing a great range in degrees of resistance to penetration by acids and bases. The influence of different concentrations and of the ions is indicated.

Two kinds of permeability are distinguished as normal and abnormal. The latter occurs in consequence of the injury to the plasma, while the former (in case of the more common acids) shows a hindering action of uninjured plasma in close agreement with the behavior of animal protoplasm.

Permeability relations of acids and bases fulfill, in the main, the requirements of the lipoid theory and are comprehensible from that standpoint.

Effect of ammonium sulphate upon plants in nutrient solutions supplied with ferric phosphate and ferrous sulphate as sources of iron, L. H. Jones and J. W. Shive (*Jour. Agr. Research [U. S.], 21 (1921), No. 10, pp. 701–728, pl. 1, figs. 9*).—Experiments were carried on by the New Jersey Experiment Stations to study, in a comparative way, the effects of ammonium sulphate in nutrient solutions upon the growth of young wheat plants, and to determine the influence of this salt on the ability of the plants to utilize iron from a soluble ferrous salt and an insoluble ferric salt. Two series of cultures were used, one of which comprised Tottingham solutions while the second consisted of the same solutions modified by substituting ammonium sulphate for the potassium nitrate in equivalent osmotic concentrations.

The plants grown in the Tottingham solutions were found invariably to produce a marked decrease in the hydrogen-ion concentrations of the solutions. Those grown in the solutions containing ammonium sulphate invariably increased the hydrogen-ion concentration of these solutions during the early stages of growth. During the first five weeks of growth the hydrogen-ion concentrations were maintained at a much higher level in these solutions than in the unmodified Tottingham solutions. Ferric phosphate, in the quantities used, was not sufficiently available in the Tottingham solutions to supply the needs of the plants for iron. On the other hand, this form of iron appeared readily available to the plants in the solutions containing ammonium sulphate. Ferrous sulphate, in the quantities used, was sufficiently available in the Tottingham solutions to satisfy the needs of the plants for iron. The solutions containing ammonium sulphate with this form of iron in quantities of more than 0.01 mg. of iron per liter were very toxic to the plants, and the degree of toxicity increased with increased amounts of iron added to the solutions. The nature of the nutrient solution with respect to the salt constituents and hydrogen-ion concentration appeared to determine the availability and the efficiency of a given iron salt for plant growth.

The absorption of copper from the soil by potato plants, F. C. Cook (*Abs. in Science, n. ser., 54 (1921), No. 1385, p. 57*).—An account is given of investigations conducted by the author in which insoluble copper compounds present in Bordeaux mixture and Pickering spray, and also a solution of sulphate of copper, were added to the soil near the roots of potato plants. Equal strengths and amounts at various intervals during the growing season were applied.

The soluble copper sulphate added directly to the soil was found to cause injury to the plants, while the insoluble copper compounds of the sprays did not. Samples of vines, tubers, and soil were taken for analyses at frequent intervals, and the leaves of the plants grown in the soil receiving the insoluble

copper were found to contain the largest amount of the copper, the roots but little, and the stems an intermediate amount. The tubers contained only traces of copper. Where the soil was treated with the copper sulphate solution the roots were injured and the normal metabolism of the vines interfered with. In these plants the roots contained more copper than the leaves.

Gaseous poisons in relation with plants, E. VERSCHAFFELT (*Pharm. Weekbl., 57 (1920), No. 39, pp. 1163–1175*).—This deals with the access and effects of gaseous poisons in relation with plants.

FIELD CROPS.

Breeding crop plants, H. K. HAYES and R. J. GARBER (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XVII+328, figs. 69*).—The book presents fundamental principles of crop breeding and summarizes known facts regarding the mode of inheritance of many of the important characters of crop plants under the topics of plant genetics, mode of reproduction in relation to breeding, field plat technique, controlling pollination, classification and inheritance in wheat and in other small grains, methods of breeding small grains, results of selection with self-fertilized crops, results of crossing as a means of improving self-fertilized crops, and farmers' methods of producing pure seeds. Special treatment is accorded breeding work with cowpeas, soy beans, velvet beans, flax, tobacco, cotton, sorghum, corn, grasses, clover, alfalfa, potatoes, vegetables, and fruit. A glossary of technical terms used, an extensive list of literature cited, and an author and subject index are appended.

Calculation of the probable error and variation statistics with reference to field experiments, E. LINDHARD (*Nord. Jordbrugsforsk., 1920, No. 7, pp. 283–291*).—A method of calculating the probable error is described, formulas entering into the mathematical operation are presented, and their use is illustrated by applying them to a supposed field experiment. Twelve references to the literature are given.

The application of electricity to increase crop production, E. MACKINNON (*Sci. and Indus. [Aust.], 2 (1920), No. 1, pp. 24–35, figs. 6*).—A review of experimental methods and results, involving the application of electricity to crop production, from 1840 to the present time.

[Report of field crops work at the Hettinger, N. Dak., Substation, 1919–1920], U. J. DOWNEY (*North Dakota Sta. Bul. 150 (1921), pp. 5–13, figs. 2*).—In continuation of work noted heretofore (E. S. R., 41, p. 824), these pages report rotations and cultural trials with wheat, oats, barley, corn, and flax; variety tests with potatoes; and field trials with emmer, millet, sweet clover, alfalfa, brome, slender wheat and Sudan grasses, sunflowers, and Dakota amber sorghum. Meteorological data secured at the substation in the years indicated are tabulated.

Wheat made its best yields on summer fallow, averaging 17.5 bu. per acre. Land spring plowed produced 4 bu. more oats per acre than disked corn land. The highest yields of corn fodder were obtained from plats fall plowed, summer fallowed, or spring plowed and deep tilled. Excelsior and Grimm alfalfa seeded in rows outyielded by wide margins in both 1919 and 1920 the same varieties broadcasted.

[Work with field crops in Guadeloupe, 1919–20], J. S. DASH (*Guadeloupe Sta. Agron. Rap., 2 (1919–20), pp. 11–20, 31–44*).—Continuing work noted previously (E. S. R., 44, p. 433), fertilizer, variety, and liming tests with sugar cane; trials of cotton and castor bean varieties and seedlings; variety tests of legumes, sorghum, and corn; and field trials of miscellaneous forage crops are

reported for the year ending June, 1920. Leading cane varieties on the red soils were B. S. F. 13 (8), B. 67, and Ba. 7924, while Big White Tanna, B. H. 10 (12), and Ba. 12079 led in indicated sucrose production on black soils.

[Field crops work in Tunis, 1915–1919], BOEUF and GUILLOCHON (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul., 24 (1920), No. 102, pp. 262–280*).—Experiments reported for the period 1915 to 1919, inclusive, include variety tests of hard and soft wheat, barley, oats, legumes, leguminous forage, and miscellaneous forage crops, and cultural and fertilizer tests with wheat.

[Work of the plant breeding station of the Agricultural Institute of the University of Halle], F. WOHLTMANN and B. KALT (*Kühn Arch., 7 (1918), pp. 190–240, figs. 2*).—The investigations reported include cultural trials of quinoa (*Chenopodium quinoa*), experiments on the prevention of animal and insect injury to cultivated plants, and cultural and breeding tests with Hintertux barley, an Alpine variety.

[Experiments of the Swedish Moor Culture Association in 1919], H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 35 (1921), No. 2, pp. 93–136*).—The results of culture, fertilizer, and variety tests on upland moor soils are reported, and the influence of meteorological conditions is pointed out.

Mixing and covering peat soil high in nitrogen content with sand increased the yields of beets, mainly through the effect of reducing frost injury. The sand-covered plats produced the highest yields. On an upland moor meadow at Flahult the yield of hay increased with the increase in sodium nitrate applied, but the most profitable application was 178.5 lbs. per acre. The use of barnyard manure in commercial fertilizers on peat soil low in nitrogen gave results indicating the value of supplying nitrogen to the grass crop in the rotation on that class of soils. The residual effect in 1919 of a heavy application of barnyard manure made in 1918 was but slightly greater than the effect of an annual normal application of phosphoric acid and potash.

The results indicated that yields on this type of soil can be maintained with commercial fertilizers alone or in combination with barnyard manure. In this test the barnyard manure gave a return per ton applied of only 27.4 feed units, representing a feeding value of 27.4 kg. of concentrates. On this kind of soil root crops receiving medium and heavy applications of barnyard manure in addition to a complete commercial fertilizer mixture showed only small increases in yield from the barnyard manure.

The nitrogen in liquid manure used on an upland moor meadow proved effective the first year, but owing to the spread of bird vetch (*Vicia cracca*) the nitrogen supplied in the manure at the close of a 6-year period was without appreciable effect. The potash furnished by the liquid manure was of marked value.

Loosening hardpan under sandy soil failed to give better crop returns than those from the same kind of soil not so treated. Early sowing on peaty soil favored the production of turnips and of an early variety of oats, while flax gave practically the same yield whether sown early or late. Different rates of sowing flax affected the yield but little and resulted in the best return from the use of 152 lbs. of seed per acre.

The results of a test conducted in 1919 showed that on sandy as well as on upland moor soils seed potatoes grown on peaty land gave better yields than those produced on sandy soil. Applying barnyard manure and plowing it under in the fall gave a greater increase in the yield of potatoes than that obtained from similar applications made in the spring.

Culture tests carried on for four years resulted in the highest average value in the form of feed units from oats followed by spring rye, barley, and spring wheat in the order given. Gull barley in a 5-year test gave on an average 360

lbs. of grain per acre more than any other variety on trial. Kron was the best yielding variety of white oats and Klock the leading variety of black oats. Of 14 varieties of potatoes grown on an upland moor soil, Harbinger, Midsommar, and Non Plus Ultra produced the highest yield of tubers and of starch. Potatoes grown on upland moor soil seemed to have better keeping qualities than those grown on sandy soil. Turnips on upland moor soil consistently outyielded Swedish turnips and field beets. Upland moor pastures are reported as furnishing excellent grazing with high milk production or satisfactory increase in the weight of the pastured stock.

Permanent pastures for Georgia, P. TABOR (*Ga. Col. Agr. Bul. 197 (1920), pp. 36, figs. 17*).—Practical information is given regarding cultural methods, grasses, legumes, and mixtures considered most suitable for the establishment of permanent pastures on different soil conditions in the State.

[Factors influencing the botanical composition of meadows on cultivated soil], L. NJAA (*Meddel. Norske Myrsldskap., 19 (1921), No. 1, pp. 3–30, figs. 4*).—Studies are reported of the changes in the botanical composition of meadows from 1909–1920, inclusive. In 1908. two fields were sown with a seed mixture including 5.3 lbs. orchard grass, 5.7 lbs. timothy, 4 lbs. meadow fescue, 2 lbs. perennial rye grass, 2 lbs. red fescue, 1.3 lbs. red clover, 1.3 lbs. alsike clover, 2.6 lbs. white clover, 3 lbs. dog's tail grass, and 3 lbs. rough-stalked meadow grass per acre. Both fields were treated yearly with 88 lbs. of superphosphate, 88 lbs. of 37 per cent potash salt, and 44 lbs. of Norwegian nitrate per acre.

Timothy proved to be the most persistent species and constituted from 66 to 74 per cent of the stand from 1911–1916, inclusive. In 1920 the percentage had sunken to 14. Meadow fescue ranged from 11 per cent to 18 per cent of the stand from 1909–1915, and had practically disappeared by the close of 1917. In 1909 the meadows contained 14 per cent of orchard grass, but this percentage declined in the immediately succeeding years and by 1915 very little of this species remained. The clovers were in evidence only the first two years with 20 per cent of the stand in 1909 and 9 per cent in 1910. Red fescue and hard fescue ranged from 2 to 7 per cent for the years 1909–1918, inclusive, and suddenly increased to 12 per cent in 1919 and 10 per cent in 1920. Rough-stalked meadow grass was represented only the first year, when it made up 10 per cent of the stand. In 1915 blue grass came into the meadows and increased to over 70 per cent of the botanical composition during the last three years. The yield of these meadows was quite well maintained after the first two years, when the returns were lowest.

On another field similar results were secured with the different grasses and clovers with the exception that meadow foxtail came into the meadow, constituting about 30 per cent of the stand the last two years, while on the other two fields it failed to establish itself.

Fields with drains different distances apart showed but little variation in the proportion of timothy, clover, meadow fescue, and orchard grass in the stand. Where drains were approximately from 28 to 60 ft. apart there was no perceptible difference either in yield or in botanical composition. Fields with drains about 33 ft. apart gave better yields of hay than those with drains nearly 100 ft. apart, all other things being equal.

Fertilizer experiments, in this connection, resulted in a marked increase in yield which consisted largely of timothy where a complete application was made. A lack of phosphoric acid as well as of potash gave a marked reduction in yield. Clover proved less sensitive to a lack of phosphoric acid than to a lack of potash.

In a long-continued fertilizer experiment, timothy on well fertilized lowland meadow at first made a poor growth but grew normally from the seventh to the ninth year, and then began to crowd out other species of grasses. The results of a comparison of different forms of phosphoric acid showed a marked decrease in yield from the second to the sixth year of the meadow where the readily available forms, Thomas slag, superphosphate, and ammonium phosphate, were used, while the crude and less available forms, Bernard phosphate and Algiers phosphate, gave the higher yields toward the close of the period, but the larger average yields of hay were obtained with the more available phosphates. The use of sand and lime gave an excellent stand of clover and timothy, while lime alone gave only a small percentage of clover in the stand. With no treatment only redtop and sorrel were produced. The application of gravel at the time of preparing lowland meadows proved of great benefit in establishing a healthy growth and a good stand of clover and timothy.

[Lolium perenne, L. multiflorum, and Bromus arvensis in experiments at Svalöf from 1911 to 1920], H. WITTE (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 2, pp. 70–83*).—The average yields of green forage for nine years of the three grasses grown in comparison are reported as follows: *L. perenne* 15,550, *L. multiflorum*, 13,980, and *B. arvensis* 19,640 kg. per hectare or 13,840, 12,442, and 17,480 lbs. per acre, respectively. The corresponding average yields from the second growth for six years are given as 480, 1,780, and 470 kg.

Seager Wheeler's book on profitable grain growing, S. WHEELER (*Winnepeg: Grain Growers' Guide, Ltd., 1919, pp. XVI+351, figs. 86*).—The volume is concerned with grain production in western Canada, and treats of soils, seed, cultural and field practices, harvesting methods, weeds and their control, grain rust and smut, and crop and seed improvement. The origin and characteristics of Marquis, Red Bobs, and Kitchener wheat, Victory oats, and Canadian Thorpe and O. A. C. barley are set forth in some detail. The book also deals briefly with selecting and growing potatoes, fairs and exhibits, the Canadian Seed Growers' Association, Government experimental farms, and advertising and marketing seed and grain. A biographical sketch of the author by H. Moorhouse is included by way of introduction.

The perfection of the technique of hybridization of the four principal grains, E. TSCHERMAK (*Ztschr. Pflanzenzücht., 8 (1921), No. 1, pp. 1–13, figs. 7*).—A description of the author's methods and experiments in the production of rye, wheat, barley, and oats hybrids.

Notes on adlay, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 3, pp. 217–222, pls. 5; also in Sunday Times [Manila], 5 (1921), No. 245, p. 9, figs. 4; Philippine Farmer, 7 (1921), No. 3, pp. 31, 32, 33, 36, figs. 2*).—Adlay (*Coix lacryma jobi*), with soft hulls and very distinct from the ordinary Job's tears, is described as a valuable food crop for tropical countries. It is cultivated in various regions of India, China, Malaya, and Japan, and in Bukidnon, Cotabato, and the Mountain Province of the Philippines. The hulled grain closely approximates wheat in starch and protein content and exceeds it in fat. On this account, adlay is considered a more complete human food than either rice or corn. Cultural directions are indicated in brief.

The barajillo, C. RENSON (*Rev. Agr. Trop., 1 (1921), No. 2, pp. 65–73, pls. 8*).—The barajillo (*Meibomia rensoni*), a perennial legume forage plant indigenous to Central America is described, and cultural directions and seed-hulling methods indicated.

Culture and production of corn [in France], L. MALPEAUX (*Vie Agr. et Rurale, 10 (1921), No. 20, pp. 314–318, figs. 2*).—Practices involved in the production of corn in France are outlined. The principal center of production is in southwestern France, a total of 847,210 acres being cultivated in 1918.

The cultivation of maize, H. WENHOLZ (*N. S. Wales Dept. Agr., Farmers' Bul. 125 (1919), pp. 43, figs. 13*).—Cultural and field practices considered best for growing the crop in New South Wales are discussed in detail.

Cotton [in the Philippines], compiled by R. B. ESPINO (*Philippine Agr. Rev., 13 (1920), No. 3, pp. 186–210*).—This compilation indicates the species of cotton cultivated in the Philippine Islands, reviews field tests conducted since 1885, and outlines cultural and field practices involved in the production of the crop. Brief notes are included on diseases and pests, adaptation, and classification.

[Swedish flax improvement], N. SYLVÉN (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 2, pp. 57–69, figs. 7*).—This article represents a paper presented at a meeting of the Swedish Flax Culture Association in March, 1921, in which some of the results in flax improvement work conducted at Svalöf are reported.

In 1918, plants selected with length of stem as a basis were divided into five classes ranging in average stem length from about 35 to 75 cm., the difference between classes being about 10 cm. (3.9 in.). In 1920, the 17 varieties leading in height ranged from 80.3 to 91.2 cm. in length of stem. The ten leading straw-producing strains in 1920 ranged in yield from 3,590 to 4,437.5 kg. per hectare (3,195 to 3,949 lbs. per acre), and the average stem length from 73.5 to 86.6 cm. The Svalöf strains Nos. 597, 598, 599, and 596 led in straw or fiber production, their yields being 4,437.5, 4,375, 4,375, and 4,218.75 kg. of straw per hectare, and their average stem length was 81.4, 81.7, 80.5, and 86.6 cm., respectively.

Hegari in Arizona, G. E. THOMPSON (*Arizona Sta. Circ. 33 (1921), pp. 4, fig. 1*).—Hegari, its uses, and soil and environmental adaptations are briefly described, and cultural methods and harvesting practices are outlined.

Variety trials with oats, R. G. STAPLEDON ET AL. (*Welsh Plant Breeding Sta., Aberystwyth [Bul.], Ser. C, No. 1 (1920), pp. 5–40*).—Yields, agronomic data, and descriptions are given of 42 oats varieties tested by the Welsh Plant Breeding Station in 1920.

Kanota: An early oat for Kansas, S. C. SALMON and J. H. PARKER (*Kansas Sta. Circ. 91 (1921), pp. 13, figs. 2*).—Kanota (Kansas No. 5179), a promising strain of Fulghum oats from Texas first grown at the station in 1916, is described, and its yields and agronomic characters are compared with those of other varieties. Yields of this variety have been noted (E. S. R., 44, p. 224).

Kanota occupies a position more or less intermediate between the red oat and white oat groups, suggesting a hybrid origin for this as well as other strains of Fulghum. This may also explain its geographic adaptation, apparently between the *Avena sativa*, or northern, and the *A. sterilis*, or southern oat district. The variety is said to be characterized by rapid early growth in spring, early maturity, resistance to late spring frosts, comparative freedom from smut, and high average yields. The authors do not indicate resistance to *Puccinia coronata* or *P. graminis avenae*.

[The effect of peas and clover on the succeeding oats crop], K. VIK (*Norges Landbr. Höiskoles Akervekst. Aarsber., 1918–19, pp. 37–41, fig. 1*).—The results of experiments conducted for eight years showed that on the average oats grown on land in clover for the two preceding years yielded approximately 132 lbs. of grain and 285 lbs. of straw per acre more than was secured from oats following peas on the same kind of soil. After growing clover, the soil to a depth of 26 cm. (about 10 in.) was found to contain per acre in the stubble and root residues of the clover approximately 3,563 lbs. dry matter, 76 lbs. nitrogen, 30 lbs. phosphoric acid, 32 lbs. potash, and 105 lbs. lime as compared with 1,285 lbs. dry matter, 22.5 lbs. nitrogen, 6 lbs. phosphoric

acid, 4.6 lbs. potash, and 30 lbs. lime furnished the soil in the corresponding residues of the pea crop.

Composition and properties of oat grain and straw, R. A. BERRY (*Jour. Agr. Sci. [England], 10 (1920), No. 4, pp. 359–414, figs. 5*).—Results are reported of a systematic study of the influence of variety, soil, climate, fertilizers, and other factors on the composition, character, and yields of oat grain and straw conducted at the experiment station of the West of Scotland College of Agriculture at Kilmarnock from 1909 to 1919. Analyses are tabulated of the kernel, straw, chaff, and husk at successive stages of growth.

Yield per acre was shown to be associated directly with the average size of the individual grains seeded. The larger grain gave the greater yields, heavier weights per bushel, and larger proportion of kernel. Although the heavier grain contained a lower percentage of nitrogen than the smaller grain, the acre yield of nitrogen in the dry kernel was greatest in the case of the heavier grain.

Rhodes grass in Arizona, S. P. CLARK (*Arizona Sta. Circ. 36 (1921), pp. 3*).—The grass is described, together with brief notes on soils, seeding, yields, and feeding value.

Sudan grass in Arizona, R. S. HAWKINS (*Arizona Sta. Circ. 35 (1921), pp. 5, figs. 2*).—Brief notes are given on the uses, feeding value, and culture of Sudan grass, and the crop is compared with Johnson grass.

Results of field experiments with sugar cane in Java, XI, J. M. GEERTS (*Arch. Suikerindus. Nederland. Indië, 28 (1920), Nos. 28, pp. 1063–1158; 29, pp. 1159–1254; 30, pp. 1255–1294, figs. 4; also Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., No. 6 (1920), pp. 232, figs. 4*).—Results of fertilizer tests conducted with different sugar cane varieties from 1905 to 1917, inclusive, are tabulated in detailed and summary form. The work, which was principally concerned with nitrogenous fertilizers, included determinations of the optimum amounts considered from economic, physiological, varietal, group, climatic, and soil type standpoints. Previous articles along this line have been noted (E. S. R., 40, p. 441; 42, p. 735).

Sugar cane varieties, G. BREMER (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 23, pp. 887–913, figs. 10; also Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., No. 4 (1920), pp. 27, figs. 10*).—Four additional varieties of sugar cane are described in continuation of similar work by Jeswiet noted heretofore (E. S. R., 42, p. 235).

Sugar cane varieties, J. JESWIET (*Arch. Suikerindus. Nederland. Indië, 28 (1920), Nos. 50, pp. 2183–2246, figs. 22; 51, pp. 2247–2305, figs. 24; also Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., No. 9 (1920), pp. 123, figs. 46*).—Descriptions of 16 varieties of sugar cane indigenous to the Malay Archipelago are presented similar to the above.

Statistics on the distribution and production of sugar cane varieties in Java in 1918 and 1919, J. VAN HARREVELD (*Arch. Suikerindus. Nederland. Indië, 28 (1920), Nos. 18, pp. 615–701, figs. 2; 49, pp. 2095–2176, figs. 2; also Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., 1920, Nos. 2, pp. 87, figs. 2; 8, pp. 82, figs. 2*).—The data presented in tabular form are similar to those noted previously (E. S. R., 40, p. 635). The leading varieties in both years include 247 B, 100 POJ, EK 28, and DI 52, occupying, respectively, 33, 24, 12, and 9 per cent of the total area in 1918, and 28.5, 16.8, 22.5, and 12.8 per cent of the total area in 1919.

Additional descriptions of sugar cane varieties, G. L. FAWCETT (*Rev. Indus. y Agr. Tucumán, 9 (1919), No. 9–10, pp. 129–152, figs. 20*).—Supplementing work already noted (E. S. R., 39, p. 642), descriptions are given of Creole canes, green Jujuy, Louzier, Lahaina, Java 234, 105 P. O. J. (Egyptian Amber),

Kavangire (Uba), Zwinga, Yon Tan San, Demerara 74, and Demarara 1135 varieties of sugar cane.

Sweet clover in Arizona, S. P. CLARK (*Arizona Sta. Circ. 34 (1921), pp. 7*).—This circular describes the important varieties of sweet clover and includes brief notes on soils; cultural and field practices for hay, silage, and pasture; and eradication methods.

Tests of tobacco selections in 1920, S. C. J. JOCHEMS (*Meded. Deli Proefsta. Medan, 2. ser., No. 19 (1921), pp. 25*).—Trials of various selections and hybrids of Deli tobacco are reported for the year 1920. Earlier work with Deli tobacco by Honing has been noted (E. S. R., 43, p. 831; 44, p. 141).

Fertilizer tests with tobacco in 1919 [in Sumatra], J. VAN DIJK (*Meded. Deli Proefsta. Medan, 2. ser., No. 14 (1920), pp. 38*).—The results of extensive fertilizer tests with tobacco in Sumatra are reported for the season indicated.

Experiments with Norwegian strains of spring wheat, K. VIK (*Norges Landbr. Höiskoles Akervekst. Aarsber., 1918–19, pp. 7–36, pl. 1, fig. 1*).—The results of cooperative culture tests in progress from 1915–1919, inclusive, with strains of Norwegian spring wheat, including some pure lines, are reported.

The Norwegian wheats outyielded the foreign varieties with which they were compared and had the added advantage of a short growing period. It is pointed out that two quite distinct forms of spring wheat, relatively uniform, are grown in Norway. In both forms the mature spikes are brown in color, but one form is practically awnless while the other is provided with strong awns. The awnless form is the one most widely grown. These forms, together with two others ranking next in importance (one awnless and the other awned, but having a light colored spike when mature), are described in detail.

[Yields secured in growing crops for seed in southern Sweden], H. WITTE (*Nord. Jordbrugsforsk., 1920, No. 6, pp. 225–247*).—A compilation is presented of the yields obtained from a list of crops grown specially for seed during the ten years 1910–1919. The average yields from a number of fields are given for each year, together with the average for the entire period. The number of crops represented in the average for the series of years ranges from about 10 to 350.

The following average yields per acre for the period are reported: Timothy 428 lbs., orchard grass 415, meadow fescue 518, *Arrhenatherum elatius* 303, perennial rye grass 750, Italian rye grass 803, brome grass 951, red clover 357, alsike clover 312, birds' foot clover 170, field beets 1,513, sugar beets 1,972, turnips 1,063, kohl-rabi 1,044, field carrots 652, and blue lupine 1,138 lbs. Notes on the seed yields of a number of garden crops are also given.

Experiment station regulations under Arizona Uniform Seed Law (*Arizona Sta. Circ. 40 (1921), pp. 8*).—Regulations governing the testing of agricultural seeds under the act approved March 19, 1921, are given together with the text of the seed law.

Danish weed growth, C. FERDINANDSEN (*Nord. Jordsbrugsforsk., 1920, No. 2, pp. 49–67*).—This article is a summary of work previously noted (E. S. R., 40, p. 832).

HORTICULTURE.

The vegetable garden, VILMORIN-ANDRIEUX (*London: John Murray, 1920, 3. ed., Eng., pp. XIX+805, figs. 890*).—This is an English edition, published under the direction of W. Robinson with an addendum by W. P. Thomson, of an old treatiste on the culture, nomenclature, and description of garden vegetables, to which has been added information on recent varieties and newly discovered diseases.

A book of gardening for the subtropics, with a calendar for Cairo, M. STOUT and M. AGAR (*London: H. F. & G. Witherby 1921, pp. 200, pl. 1, figs. 12*).—A popular handbook.

The romance of our trees, E. H. WILSON (*New York: Doubleday, Page & Co., 1920, pp. XVI+278, pls. 45*).—A collection of essays, written in nontechnical language, upon the history, botany, and importance of many forest, ornamental, nut, and fruit trees from different parts of the world, and pointing out the intimate association of trees and mankind.

The improvement of plants through bud selection, A. D. SHAMEL (*Honolulu: Hawaii. Sugar Planters' Assoc., 1921, pp. [4]+28, pls. 41*).—A well-illustrated paper dealing with bud variation in plants. Numerous citations to the origin of new varieties by bud mutation are given, followed by a general discussion of the principles and practices of plant improvement by bud selection, particularly as applied to the amelioration of existing horticultural varieties. A bibliography of 78 titles is included.

Studies on the Cassaba and Honey Dew melons, H. W. YOUNGKEN (*Amer. Jour. Pharm., 93 (1921), No. 2, pp. 104–115, figs. 12*).—A paper relating to the origin, history, histological structure, and chemical constitution of the Cassaba and Honey Dew melons. The author states that the latter, commonly described as of American origin, is in reality an old French variety.

Name and description of the new fruits, W. H. ALDERMAN, M. J. DORSEY, and C. HARALSON (*Minn. Hort., 49 (1921), No. 9, pp. 225–229, fig. 1*).—Brief descriptions and comments are given for 22 new varieties of orchard and small fruits, originated at the Minnesota Fruit-Breeding Farm. One of these fruits, the Zumbra, whose probable parentage includes the pin, sweet, and sand cherry, is deemed especially promising on account of its hardiness and value for sauce and preserves.

The relative values of cover crops, H. THORNBER (*Better Fruit, 16 (1921), No. 2, p. 9*).—A further report (E. S. R., 44, p. 338) upon maintenance of fertility experiments at the Montana Horticultural Substation.

Five treatments under comparative test are considered, namely, "(1) clover two years, one crop removed for hay, second crop plowed under; (2) clover two years, no growth removed, and plowed in fall; (3) clover two years, all growth removed, then plowed in fall; (4) peas two years with all growth plowed under; and (5) peas two years plus manure and all plowed under. The year following the two years of cover crops all the plats are clean cultivated to get rid of the weeds, then the same rotation is started again."

A table showing the average heights and diameters of the trees in the different plats, and the average annual yield per tree for the last four years for McIntosh and Rome Beauty varieties is included. Little difference is indicated in vegetative growth, but a marked increase in yield is noted in favor of the clover plats from which none or only part of the hay was removed.

The commercial apple industry of North America, J. C. FOLGER and S. M. THOMSON (*New York: Macmillan Co., 1921, pp. XXII+466, pls. 24, figs. 10*).—A comprehensive discussion dealing in particular with the commercial phases of apple production, with special reference to (1) regional distribution of important commercial plantings, (2) economic problems such as cost of production and marketing, and (3) scientific cultural methods. Propagation is not discussed.

Stocks for the stone fruits, R. G. HATTON (*Jour. Pomol., 2 (1921), No. 4, pp. 209–245, pls. 11*).—This paper, a further contribution from the East Malling Research Station, Kent, England, upon the general subject of fruit stocks (E. S. R., 44, p. 42), discusses certain features of the propagation of the peach,

plum, apricot, and nectarine. The author, pointing out the multiplicity in number and form of the commercial stocks, describes the principal types and the methods of propagation in common practice. It was observed that the individuals of a commercial stock not only differed notably in appearance but also in their suitability.

A successful method of layering is described, whereby the author was able to rapidly increase selected types of the more important stocks. Technical descriptions of one-year plants are given for 20 of these true types and for the flowers, fruit, and tree habits of 11. The results of a budding and grafting test of several plum varieties on improved stocks indicate marked variability in the compatability between stock and scion. Buds apparently were more sensitive in this respect than grafts. Certain varieties, as Victoria and Rivers Early, were more successfully worked than others.

In conclusion the author states that insufficient time has elapsed to allow for more than a preliminary report, but that sufficient evidence is at hand to warn against the indiscriminate use of peach and plum stocks.

The akala berry of Hawaii, J. S. Rock (*Jour. Heredity, 12 (1921), No. 4, pp. 146–150, figs. 3*).—The akala (*Rubus macraei*), two distinct varieties of which were observed by the author, is deemed of value on account of the large size, juiciness, and good quality of its fruit and potential breeding possibilities.

Which are the hardy varieties of raspberries, blackberries, and dewberries? M. J. Dorsey and C. Haralson (*Minn. Hort., 49 (1921), No. 6, pp. 161–165, figs. 2*).—A popular report on the comparative resistance of varieties of small fruits to freezing injury, based on experimental data obtained at three Minnesota points, Zumbra Heights (Fruit Breeding Station), Bay Lake, and Cloquet. Latham, King, and Sunbeam red raspberries indicated their value for northern climates.

The strawberry of to-morrow, J. L. Stahl (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 50, 51*).—Brief comments are given upon several strawberry varieties and their behavior in western Washington. Ettersburg 121 is considered the most promising variety tested at the station in the last 10 years.

The cultivation of vineyards in southwestern France, A. du Pont de Nemours (*New York: Brentano's, 1920, pp. XI+273, pls. 8*).—A popular essay upon grape culture and wine making in France.

The pruning of the vine, H. E. Laffer (*N. S. Wales Dept. Agr., Farmers' Bul. 140 (1921), pp. 42, figs. 25*).—A treatise on the principles and practices of pruning the grape as applied to the *Vitis vinifera* varieties grown in New South Wales.

[The oil content of olive varieties], R. Fowler (*So. Aust. Min. Agr. Rpt., 1920, pp. 21, 22*).—Tabulated data showing the yield of oil per ton of olives and the mean average during three years' tests are given for 34 varieties grown at the Government Experiment Orchard, Blackwood, South Australia.

Effect of girdling or ringing the avocado, J. E. Coit (*Calif. Citrogr., 6 (1921), No. 12, pp. 416, 417*).—The successful experiences of several practical avocado growers are cited to show that girdling of limbs in October will often induce earlier and more abundant fruit production. The physiology of girdling is briefly considered.

A new tangelo, W. T. Swingle and T. R. Robinson (*Jour. Heredity, 12 (1921), No. 4, pp. 151–153, fig. 1*).—A brief descriptive account of a fruit originated at Eustis, Fla., in 1908, by crossing a seedling grapefruit with pollen of the Sampson tangelo, the latter a grapefruit tangerine hybrid.

The coconut, E. B. COPELAND (*London: Macmillan & Co., Ltd., 1921, 2. ed., rev., pp. XVI+225, pls. 23, fig. 1*).—A revision of an edition previously noted (E. S. R., 32, p. 339).

Irvingia gabonensis in Dahomey, A. HOUARD (*Agron. Colon., 6 (1921), No. 39, 73–81*).—A descriptive account of two varieties of *I. gabonensis*, one bearing yellow globular and the other green, slightly oblate fruits.

The pejibaye: A neglected food plant of tropical America, W. POPENOE (*Jour. Heredity, 12 (1921), No. 4, pp. 154–166, figs. 6*).—This palm, constituting since remote periods a very important source of food in many parts of tropical America, is deemed worthy of dissemination throughout similar latitudes. Data are given relative to botany, composition and food value, uses, varieties, etc.

The establishment of plantations in the Mayumbe forest (Belgian Kongo), R. VERSCHUEREN (*Ann. Gembloux, 26 (1920), Nos. 4, pp. 155–165; 11, pp. 516–519; 27 (1921), Nos. 6, pp. 189–195; 8, pp. 258–267, figs. 10*).—Directions are given, in addition to general discussion, for the establishment of mixed plantations of the oil palm, banana, and pineapple in the Belgian Kongo, including information relative to selecting the site, clearing the land, disposition of valuable lumber, preparation of the soil, planting plans, etc.

Fertilizer experiments on pecans conducted by the U. S. Department of Agriculture, J. J. SKINNER (*Ga.-Fla. Pecan Growers Assoc. Proc., 1921, pp. 4–11, fig. 1*).—A contribution from the Bureau of Plant Industry relative to investigations under progress at five Georgia and Florida points to determine the most satisfactory fertilizer for pecans. The object of the tests, including 21 different fertilizer treatments, is not only to reveal the best formula but also the best sources of ingredients. Legumes are grown each year on all the five areas. Owing to the incompleteness of the investigations, begun in 1918, the author points out the impossibility of drawing any permanent conclusions.

Sufficient data has been obtained, however, from one of the tests, located on a Greenville sandy loam at De Witt, Ga., to indicate the superior value for young trees of a complete formula containing a high nitrogen content. It was found that a fertilizer containing nitrogen from three sources, namely, nitrate of soda, ammonium sulphate, and cottonseed meal, was much superior to that containing nitrogen from one source.

Results obtained on an Orangeburg sandy loam at Putney Station, Ga., with trees nine years old in 1918 not only substantiated the above but in addition indicated that for older trees the proportion of nitrogen may be decreased, while that of phosphoric acid may be beneficially increased. Formulas are suggested for both young and producing trees.

Spraying pecan trees, J. B. DEMAREE (*Ga.-Fla. Pecan Growers Assoc. Proc., 1921, pp. 11–16*).—The principles and practices of spraying as applied to the pecan are discussed.

Camphor-producing trees, A. CHEVALIER (*Rev. Bot. Appl. and Agr. Colon., 1 (1921), No. 1, pp. 12–21*).—A discussion of several camphor-producing species, their origin, geographical distribution, and yield capacities. It is recommended that prospective planters procure their seed from trees of the true camphor of Formosa and improve inferior trees by grafting.

Medicinal plant industry, T. MEYER (*Arzneipflanzenkultur und Kräuterhandel. Berlin: Julius Springer, 1919, 3. ed., rev., pp. [VII]+188, figs. 21*).—A manual treating of the culture, harvesting, curing, and commercial preparation of medicinal and aromatic plants susceptible of cultivation in Germany.

Raising chrysanthemum seedlings, P. A. CRAGG (*Natl. Chrysanthemum Soc. Trans., 1920, pp. 6–16, figs. 3*).—The author briefly considers the morphology of the flower of the chrysanthemum and outlines his methods of crossing and growing seedlings.

Hybridization in iris, M. L. SAWYER (*Iowa Acad. Sci. Proc., 26 (1919), pp. 363, 364*).—In reciprocal crosses between two iris species, *I. pseudocorus* and *I. versicolor*, success was obtained when the latter species was used as the ovule parent.

What America has done for the iris, J. C. WISTER (*Gard. Mag. [New York], 33 (1921), No. 4, pp. 234–239, figs. 12*).—The rise of iris culture in the United States is reviewed, with special reference to the productions and activities of prominent breeders.

The English flower garden and home grounds, W. ROBINSON (*London: John Murray, 1921, 13. ed., rev., pp. XII+796, figs. 359*).—A revised edition in two parts, the first dealing with garden design and management and the second a dictionary of useful and ornamental trees and plants.

FORESTRY.

A national forest policy, H. S. GRAVES (*South. Forestry Cong. Proc., 2 (1920), pp. 40–53*).—The author, pointing out the serious depletion of our forest resources, emphasizes the necessity of an adequate national forest policy, broad enough to receive the support of both public and private organizations and individuals.

How the public forests are handled, H. A. SMITH (*U. S. Dept. Agr. Yearbook 1920, pp. 309–330, figs. 11*).—A popular account of the activities of the Forest Service in regulating grazing and timber cutting and in fire protection. It is pointed out that the foresters in charge, by efficient and judicious management, have made possible the annual feeding of large numbers of cattle and sheep without injury to the forests, have enabled the cutting of a stable supply of lumber, and have greatly reduced the losses from fire by construction of roads, lookout stations, and maintenance of efficient patrols.

Weeks Law cooperation, J. G. PETERS (*Northeast. States Forest Fire Conf. Proc., 1920, pp. 5–12*).—A discussion of benefits that have been derived from the operation of the Weeks Law, namely, extension of and more effective fire protection, a closer relationship between States and Federal agencies, and recognition by the Government of its obligation in forest-fire protection.

Wood for the Nation, W. B. GREELEY (*U. S. Dept. Agr. Yearbook 1920, pp. 147–158, figs. 5*).—Attention is directed to the vast quantity of lumber required each year on the farms, the railways, and in the cities of the United States. It is stated that 60 per cent of the original timber is gone, that the nation is using four times as much lumber per year as is being grown, and that meanwhile enormous areas of potentially productive cut-over lands are lying idle. The problem is deemed of national scope, and the farmer, possessing as he does the greater part of the existing timber, is urged to take a greater interest in scientific management and in reforestation.

Report of the superintendent of forestry, C. S. JUDD (*Hawaii. Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1919–20, pp. 19–45, pls. 12*).—The activities of the division of forestry for the biennial period ended December 31, 1920, are discussed in this report. Forest protection and extension were continued as the main lines of work (E. S. R., 41, p. 149).

The suppression of Hilo grass, fencing of forest reserves and exclusion of grazing cattle, and control of fires were the features of protection work. No new reserves were proclaimed, but several alterations in area were made in order to release agricultural land, etc. Several new species, including the chaulmoogra oil tree, were imported and in some cases distributed. The seven tree

nurseries are described as active, a total of 71,641 trees of 37 different species having been set out on Kawai, Oahu, and Maui. A list of publications issued during the period is included, and a tabulation given of the name, location, and area of all the forest reserves in the Hawaiian Territory on January 1, 1921.

Report of the forest nurseryman, D. HAUGHS (*Hawaii. Bd. Commrs. Agr. and Forestry [Bien] Rpt., 1919–20, pp. 61–67*).—A brief report for the two years ended December 31, 1920, relative to the collection and exchange of seed, distribution of trees from the Government nurseries, and activities of the several subnurseries.

Land classification, A. CARY (*South. Forestry Cong. Proc., 2 (1920), pp. 119–129*).—A discussion of the advantages to be derived from a reliable classification of land in relation to its suitability.

Growth study and normal yield tables for second growth hardwood stands in central New England, J. N. SPAETH (*Harvard Forest Bul. 2 (1920), pp. 21, pl. 1, fig. 1*).—A mensural study of over 18,000 forest trees, contained in 48 plats distributed over an area of 175 square miles in Worcester County, Mass. Only fully stocked stands of an even age were included, and measurements were taken on all trees having a diameter of over 2 in. at breast height. The results are summarized by the author as follows:

"After cutting the mixed hardwood type regenerates itself substantially unchanged and generally follows the logging of pine stands. The type is, therefore, greatly on the increase in the region. At 70 years on the better sites, fully stocked stands produce 20,000 and on the poorer 13,000 board feet of saw timber. In spite of wide variation in percentages of species in mixture, for a given age, site, and density, the volume in board feet, cubic feet, and cords is constant. The volume of a tree of given height and diameter in cords and cubic feet is the same regardless of species."

The pines of the South, J. S. ILLICK (*Amer. Forestry, 27 (1921), No. 333, pp. 551–559, 574, figs. 16*).—Seven species of pine, commonly known as longleaf, shortleaf, loblolly, Cuban, pond, spruce, and sand pines, are illustrated and discussed in relation to their distribution, habits of growth, and economic value. A leaf, cone, and bark key is given for the species.

The silviculture of Indian trees, R. S. TROUP (*Oxford, Eng.: Clarendon Press, 1921, vols. 1, pp. LVIII+336+III, pls. 103, figs. 16; 2, pp. XI+337–784+IV, pls. 112, figs. 27; 3, pp. XII+785–1195, pls. 135, figs. 18*).—This comprehensive and well-illustrated work, based on data obtained at the Forest Research Institute, Dehra Dun, and at outlying stations, enlarged with observations from miscellaneous sources, deals primarily with forest trees of the Indo-Burmese region, although a few exotic species are included. The subject, mainly treated from a silvicultural standpoint, includes botanical descriptions and delineations of seedlings. The genera and species are arranged according to natural botanical orders.

Tree planting for the farm, T. R. SIM (*So. African Jour. Indus., 4 (1921), Nos. 3, pp. 218–223; 5, pp. 473–478; 6, pp. 554–562; 7, pp. 666–672*).—A popular review of the various factors involved in forest tree planting on South African farms, including location of site, preparation of soil, selection of species, commercial culture, etc.

Breaking the power of prairie winds, C. G. BATES (*Canad. Forestry Mag., 17 (1921), No. 6, p. 336, figs. 3*).—A brief account, with graphical illustrations, of methods employed in measuring the effect of windbreaks in lessening the force of the wind, in checking evaporation, and in influencing the humidity of the air.

Measurements of wood fiber, H. S. CONARD and W. A. THOMAS (*Iowa Acad. Sci. Proc., 26 (1919), pp. 333–335*).—Determinations of the length and width of

the fiber are given for 41 species of woods. The greatest length, 6.7 mm., was found in *Picea sitchensis* and the shortest, 0.46 mm., in *Acer negundo*. It is suggested that the data may be of practical value to the wood-pulp industry.

Putting wood waste to work, S. T. DANA (*U. S. Dept. Agr. Yearbook 1920, pp. 439–462, figs. 9*).—Emphasis is placed upon the function of the Forest Products Laboratory at Madison, Wis., in assisting commercial enterprises in the more economical use of wood.

The author concludes that "the $30,000,000 which wood-using industries are already saving each year through the partial application of information now available is insignificant in comparison with the possibilities. What has so far been accomplished in putting our wood waste to work and in bringing about the more effective utilization of material already used constitutes but a beginning."

DISEASES OF PLANTS.

Synthetic review [of plant pests and diseases], L. FULMEK and A. STIFT (*Centbl. Bakt. [etc.], 2. Abt., 51 (1920), No. 12–15, pp. 315–336*).—This review, covering the year 1917, deals with a few insect pests, but principally plant diseases and other injuries due to bacteria, fungi, or nonparasitic agencies, also with protective preparations and measures.

Synthetic review [of plant pests and diseases], E. RIEHM (*Centbl. Bakt. [etc.], 2. Abt., 51 (1920), No. 21–25, pp. 449–490*).—This comprises a compact review of the more important contributions appearing during 1915–1918 regarding causes of injury and loss to economic plants, with a list of related literature including 154 titles.

[Mycological studies], F. HÖHNEL (*Ber. Deut. Bot. Gesell., 38 (1920), No. 3, pp. 96–116*).—In these three articles the author notes briefly the results of studies on the characters, behavior, classification, and synonymy of Pseudopeziza, Pyrenopeziza, Ephelina, and Spilopodia; Phlyctaenia, Botryosphaeria, Epiphyma, and Pilgeriella.

Principal and related fruiting forms of the Ascomycetes, I, H. KLEBAHN (*Haupt- und Nebenfruchtformen der Askomyzeten, I. Leipzig: Borntraeger Bros., 1918, pt. 1, pp. XI+395, figs. 275*).—This discussion, which is systematic in form, is a presentation of original data and selected observations regarding the interrelations of the ascospore and conidial forms among the Ascomycetes.

Production of perithecia by an Aspergillus under the influence of a bacterium, A. SARTORY (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 25, pp. 1113, 1114*).—In the study of certain fruit rots, the author found that a bacterium was always associated with a fungus of the genus Aspergillus. This was easily isolated and studied and was found to produce freely, under favorable conditions indicated, perithecia, asci, and ascospores, production of conidia being frequent but scanty. The formation of perithecia and asci was always associated with the production of a striking golden color.

No other bacterium was found able to sustain this close necessary relation. The fungus produced readily, on several familiar media tested, perithecia, asci, and ascospores.

The author has recorded previously (E. S. R., 42, p. 131) a case involving the necessity (to sporulation) of association with a bacterium as prerequisite to sporulation by a fungus.

Two new Fusariums, E. PARAVICINI (*Ann. Mycol., 16 (1918), No. 3–6, pp. 300–319, pl. 1*).—Data are given regarding two fungi which are designated as new species under the names *F. luteum* and *F. rubrum*.

The artificial culture of Phoma, J. WESTERDIJK and A. VAN LUIJK (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 4 (1920), pp. 26–30*).—Study is indicated of several species of Phoma which are of agricultural importance.

Systematization and biology of some Plasmoparas, A. WARTENWEILER (*Ann. Mycol., 16 (1918), No. 3–6, pp. 249–299, pls. 3, figs. 13*).—The several sections of this article deal respectively with a morphological study regarding the classification value of conidia and conidiophores of some Plasmoparas, also observations on overwintering and deductions regarding the systematic position of *P. nivea*, *P. pygmaea*, and *P. densa*.

Crown gall, a serious disease, A. FRANK (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 51–53, fig. 1*).—Attention is called to the effect of crown gall on various plants. The careful and rigid inspection of the fields and orchards and the destruction of all infected plants is given as the only successful remedy for the control of this trouble.

Varietal susceptibility of cereals to rust fungi, G. GASSNER (*Centbl. Bakt. [etc.], 2. Abt., 49 (1919), No. 7–9, pp. 185–243*).—Studies on rust as affecting varieties of barley, oats, wheat, and maize are detailed, with discussion also of the general problem of susceptibility to rust, including the influence of internal and external factors and the nature of the ultimate causes of susceptibility and of varietal differences in this respect.

The barberry and stem rust in Wisconsin, J. G. DICKSON (*Wis. Dept. Agr. Bul. 33 (1920), pp. 144–149, figs. 3*).—It is stated that it has been definitely proved that the early spring distribution of wheat-stem rust depends upon the barberry, which is still sufficiently numerous in many localities to cause heavy losses. The red rust stage occasionally lives over winter, but rust develops too late from this source to damage the grains.

Resistance to stem rust in Kanred wheat, R. F. ALLEN (*Science, n. ser., 53 (1921), No. 1382, pp. 575, 576*).—A preliminary account is given of investigations conducted jointly by the California Experiment Station and the U. S. Department of Agriculture on resistance to stem rust in Kanred wheat.

From cytological study of *Puccinia graminis tritici* it was found that the unrediniospores germinated on Kanred leaves, and that the germ tubes made their way directly to the stomata, where the tip of the germ tubes swell to form appressoria and practically all of the protoplasm flows into it, leaving the germ tube empty. Under favorable conditions for germination the appressoria develop promptly and in great numbers, but in spite of this, relatively few enter the stomatal slit in Kanred to form mycelium within the host.

A large number of inoculation experiments were made, and only about 10 per cent of the young rust fungi were found to enter the host, 90 per cent remaining outside the stomata until they dried and fell off.

Tangential sections of Kanred and Mindum, a less resistant variety, showed that the stomatal slit in Kanred was extremely long and narrow, while in the other variety the stomata are short and variable in width, averaging about twice that of Kanred. It is thought probable that the naturally small stomatal opening of Kanred is further narrowed by the action of the guard cells when an appressorium comes in contact with the stoma.

Seed treatment for the prevention of cereal smut, A. K. PEITERSEN (*Colo. Agr. Col. Ext. Bul., 1. ser., No. 185 A (1921), pp. 7, figs. 4*).—Popular descriptions are given of the soaking, sprinkling, and spraying methods for the treatment of different kinds of seed grain for the control of smut.

A fungus disease suppressing expression of awns in a wheat-spelt hybrid, L. E. THATCHER (*Jour. Agr. Research [U. S.], 21 (1921), No. 10, pp. 699, 700, pl. 1*).—In a contribution from the Ohio Experiment Station, the

author gives a brief account of experiments in growing a number of F_2 hybrids between *Triticum vulgare* and *T. spelta*, the grains having been treated with spores of *Tilletia foetans* before planting.

An examination of the matured plants showed that they could be divided into three classes: Those of which all the grains of all the spikes were infected; those of which all the grains of part of the spikes were infected; and those of which all the grains of all the spikes were free from infection. An examination of the diseased plants showed that those plants which were awned segregates of the class in which part of the spikes were diseased showed normal development of the awns in the disease-free spikes and a suppression of awns in the diseased spikes. No spikes were found which contained both diseased and disease-free kernels.

The relation of the health of the host and other factors to infection of Apium graveolens by Septoria apii, H. E. THOMAS (*Bul. Torrey Bot. Club, 48 (1921), No. 1, pp. 1–29*).—Studies here detailed indicate a comparatively narrow specialization by *S. apii* on *A. graveolens*, which suggests a promising outlook for experiments in breeding for resistance.

S. apii, although it readily assumes the saprophytic habit, has become so adapted to its host that increased growth in the latter favors the development of infection. Such increase of growth is produced by use of nitrates with a complete nutrient solution or by top-dressing with sheep manure. The acceleration is manifested in both the number of infections established and the size of the spots produced. On the other hand top-dressing the soil with lime decreases the infection. Also the infestation of the roots of celery plants by nematodes partially or entirely inhibits the development of the fungus. The retention of chlorophyll and water in the tissue adjacent to infected spots after these have disappeared from the remainder of the leaf is further evidence of a tendency toward mutualism between fungus and host.

As regards the age of different tissues of the same celery plant in relation to infection, it appears that there are two entirely separate conditions operating, one governing the establishment of infection and the other determining the rate of subsequent mycelial spread.

Controlling downy mildew of lettuce, A. T. ERWIN (*Iowa Sta. Bul. 196 (1921), pp. 305–328, figs. 7*).—Results are given of an investigation on the control of downy mildew of lettuce, a destructive garden and greenhouse disease due to *Bremia lactucae*. In connection with the investigation several phases of the life history of the fungus were given attention. Marked differences were observed in susceptibility on the part of different varieties and types of lettuce to the disease.

In conjunction with this investigation, a study was made of wild lettuce as a host of the organism, as well as the possibility of infection in the soil. Several species of wild lettuce were found to be infected by *B. lactucae*, and as regards soil relationship to the organism it appears that conidia of the fungus may survive in dry soil over summer but are probably destroyed by severe winter temperatures.

Control measures worked out indicate that the downy mildew is primarily a seedling disease and may be controlled by spraying with a 4:4:50 Bordeaux mixture as soon as the plants are up, with a second application two or three days before they are pricked off. In some instances a third spraying before the plants are placed in the permanent beds may prove advantageous. In addition to the application of fungicides, attention should be paid to proper ventilation and keeping the foliage as dry as possible during periods of dark, cloudy weather.

Studies on potato canker control, E. SCHAFFNIT (*Ztschr. Pflanzenkrank., 30 (1920), No. 2–3, pp. 59–67*).—A briefly detailed account is given of studies on soil infection with *Chrysophlyctis endobiotica*, varietal resistance thereto, and means tending to hinder the spread of the disease organism, including chiefly the employment of resistant or immune varieties.

The mosaic disease of the Irish potato and the use of certified potato seed, C. W. EDGERTON and G. L. TIEBOUT (*Louisiana Stas. Bul. 181 (1921), pp. 3–15, figs. 3*).—The mosaic disease, two forms of which are recognized, is said to be the most important potato disease in Louisiana, occurring in every section where the variety Bliss Triumph is grown and frequently causing a heavy loss. Other varieties which are grown to some extent are less subject to injury, but Bliss Triumph is said to be the variety most extensively grown for market purposes. The principal damage is said to be due to primary infections, secondary infections being of comparatively little consequence in Louisiana unless tubers are grown for planting a fall crop.

Commercial uncertified seed tubers shipped into Louisiana are, as a rule, of very poor quality, and during the past year certified seed from some of the Northern States has been placed on the market. Most of the certified seed has given better yield than uncertified seed, and the authors recommend as far as possible obtaining strains of varieties that are known to be specially resistant to the mosaic disease. In this connection it is stated that consideration must be given to mosaic disease by northern growers of certified seed if they expect to make this seed popular in the Southern States.

Seed selection for the control of potato disease, R. W. GOSS (*Nebr. Potato Impr. Assoc. Ann. Rpt., 2 (1920), pp. 67–74, figs. 2*).—Chief among the potato diseases of Nebraska is potato mosaic. Several other diseases which are present can be controlled only by careful seed selection. Other diseases (Rhizoctonia and scab) which are carried both on the seed and in the soil may be controlled by employing seed treatment and clean soil.

Two Sclerotium diseases of rice, W. H. TISDALE (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 649–658, pls. 5*).—Descriptions are given of a seedling blight of rice caused by *S. rolfsii* and a stem rot due to *S. oryzae*.

The diseases were observed in 1919 at the Rice Experiment Station, Crowley, La., and were made the subject of a special investigation by the Bureau of Plant Industry, U. S. Department of Agriculture.

Practical use of curly leaf symptoms, H. H. P. SEVERIN (*Facts About Sugar, 12 (1921), Nos. 9, pp. 170, 171, 173, figs. 14; 11, pp. 212–214, 217, figs. 13*).—Having checked up during the outbreak of curly leaf in 1918–19 the percentage of blighted beets in practically all of the large beet centers in California, and noted such conditions as environmental factors and the special effects of drought, the author here undertook a critical diagnosis of the disease in its bearings upon related or somewhat similar troubles and the interests involved. The presence in this connection of several insect pests was noted.

Studies in the physiology of parasitism with special reference to the secretion of pectinase by Rhizopus tritici, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 609–625*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give an account of investigations on the effect of solutions in which *R. tritici* was grown and of the powdered hyphae on disks of sweet potato.

The fungus was found to produce a wonderful intra and extra-cellular pectinase, when grown in sweet potato decoction, which was able to accomplish the complete maceration of raw sweet potato disks. The temperature reaction and the effects of various factors on the activity of the enzyms are described at

some length. *R. tritici* was found to be incapable of penetrating or dissolving the epidermis of the sweet potato, but when entrance to the underlying tissues had been secured it progressed with great rapidity and acted in advance of its growth.

Respiration and carbohydrate changes produced in sweet potatoes by Rhizopus tritici, J. L. WEIMER and L. L. HARTER (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 627–635*).—As a part of investigations on the effect of *R. tritici* on sweet potatoes mentioned above, the authors give an account of studies to determine the relative rate of respiration, as measured by the carbon dioxid given off by the two halves of sweet potatoes, one of which was rotted by *R. tritici*, and to learn how the starch, cane sugar, and reducing sugar content of the two corresponding halves differed at the end of the experiment. It was found that the decayed half of the sweet potato gave off a total of from 6.3 to 7.8 times as much carbon dioxid as the healthy portion.

At the close of the experiment the starch, cane sugar, and reducing sugar were determined, and it was found that there was a smaller amount of starch, cane sugar, and total sugars in the decayed sample than in the healthy one, while the reducing sugars were increased in two experiments and decreased in two. The total quantity of carbohydrates lost in the decayed sample appeared greater than that lost through respiration, and it is believed that a portion of the carbohydrates was used in the production of acids, alcohol, etc.

Wound-cork formation in the sweet potato, J. L. WEIMER and L. L. HARTER (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 637–647*).—As a further contribution to the rot of the sweet potato due to *R. tritici*, the authors give an account of investigations on the ability of the sweet potato to form a cork layer over wounds when the environmental conditions are favorable.

The production of a cork layer was found to be preceded by the formation of a layer of starch-free cells, usually 3 to 10 cells deep, beneath the injured surface. Cross walls began to appear from the second to the third day, and by the sixth day a distinct layer of cork cells formed a covering over the wound. The length of time necessary to form an impenetrable barrier over a wounded surface varied with conditions, temperature and humidity being important factors. This process took place more rapidly at 33° C. than at any other temperature tried, and a relative humidity of from 95 to 100 was found favorable for cork production. No well-developed cork layer was produced over wounds under the conditions existing in the sweet potato storage house, but a hard, dry surface covering was formed through which infection by artificial means could not be obtained. The results of numerous experiments are held to indicate that the healed surface of a wounded sweet potato forms a fairly efficient barrier against infection by microorganisms.

Effect of dormant lime sulphur upon the control of apple blotch, E. F. GUBA (*Science, n. ser., 53 (1921), No. 1377, pp. 484, 485*).—On account of the repeatedly published statement that strong solutions of lime sulphur, applied before the buds begin to swell, perfectly controlled apple blotch due to *Phyllosticta solitaria*, the author has carried on some investigations which have led him to disagree with that statement, but he claims to have discovered an explanation for the partial control by the dormant sprays applied late.

Two types of apple blotch infection are recognized. In the first, the canker is developed from a single infection, becomes apparent in late summer, and ceases active growth upon the appearance of cold weather. In the second type the infectious surface advances from the initial canker the following spring, approximately two weeks after the buds burst open, and becomes dotted with pycnidia simultaneously with the advance of the canker. The first form described is the initial canker, and bears pseudo-pycnidia which are completely

or partially differentiated into spores by the time it is customary to apply the dormant spray. Lime sulphur applied at this time actually kills the spores and sporidal layer within the differentiated pseudo-pycnidia, but it was found to have absolutely no effect upon the mycelium of the organism ramifying throughout the cortical tissue beneath.

Relations between mistletoe and pear trees, E. HEINRICHER (*Ztschr. Pflanzenkrank., 30 (1920), No. 2–3, pp. 41–51, fig. 1*).—An attempt was made to ascertain the reasons for current contradictory statements regarding the prevalence of mistletoe on pear trees, also to ascertain the actual prevalence and the underlying reasons.

Development of mistletoe on the main stem appears to be particularly dangerous, as is also the development of light-requiring mistletoes in the crown where they shade the host. In one case reaction by the tree to the first infection was very marked, to the second very slow and weak at first but later quite strong.

Diseases and insect injuries of cane fruits in Wisconsin, 1919, L. K. JONES (*Wis. Dept. Agr. Bul. 33 (1920), pp. 149–157, figs. 6*).—This account, besides dealing with insect pests and injuries therefrom, deals also with crown gall (*Bacterium tumefaciens*), anthracnose (*Plectodiscella veneta*), yellows, spur blight (*Mycosphaerella rubina*), cane blight, leaf spot (*Septoria rubi*), and orange rust (*Gymnoconia interstitialis*).

The presence of ascospores of Oïdium tuckeri on grape stocks, K. GERHARDT (*Ber. Deut. Bot. Gesell., 38 (1920), No. 4, pp. 156–158*).—An account is given of incomplete studies recording the presence of asci containing ascospores as noted in November, 1919, in the botanical garden at Jena.

Citrus canker in South Africa and its eradication, I. B. P. EVANS (*So. African Jour. Indus., 2 (1919), No. 1, pp. 13–34, figs. 14*).—This contribution, though more detailed than those previously noted (E. S. R., 40, p. 349; 41, p. 452), is intended to set forth briefly the governmental steps taken to eradicate citrus canker, to outline the progress made, and to point out the necessity for continuing the campaign.

In addition to an account of the disease as regards symptoms, progress, and effects following infection, a short history of the disease is given, relating particularly to South Africa.

The eradication of citrus canker, E. M. DOIDGE (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 2, pp. 124–130*).—It is stated that recent progress in reducing citrus canker in South Africa has fully justified the steps referred to by Evans as noted above.

Tabular data show an increase in the number of orchard tree infections from 217 in July, 1917, to 3,889 in January, 1918, and a decrease (with few increases) to 2 (each) for November and December, 1919.

The wither-tip of limes (*Jour. Bd. Agr. Brit. Guiana, 13 (1920), No. 1, pp. 24, 25*).—During July and August, 1918, lime trees throughout British Guiana were affected with a wither-tip (*Gloeosporium limetticolum*) attacking plants of all ages. The appearance of the disease is described. Fruits appear to be immune to the attack after they are half grown, though they may be attacked by way of injuries when ripe.

Bordeaux mixture made up to 4:4:50, to which has been added for each gallon 2 lbs. resin, 1 lb. washing soda (crystals), and 1 gal. water, is effective if applied as often as necessitated by climatic conditions.

Bud rot, J. S. NEDD (*Jour. Bd. Agr. Brit. Guiana, 13 (1920), No. 1, pp. 14–19*).—Coconut bud rot is said to be caused by bad drainage, want of proper soil nutriment, and the presence of poisonous gases.

A newly discovered nematode connected with a serious disease of the coconut palm, N. A. COBB (*West Indian Bul., 17 (1919), No. 4, pp. 203–210, figs. 5*).—These notes record observations made on specimens of coconut palm from Grenada. The diseased material was found to contain a nematode, which was studied and has been described as a new species (*Aphelenchus cocophilus*), with discussion bearing upon protection against this enemy of the coconut palm.

A bacterial disease of gladiolus, L. MCCULLOCH (*Science, n. ser., 54 (1921), No. 1388, pp. 115, 116*).—The author describes a bacterial disease of gladiolus that has been under observation for a number of years. The organism causing the disease has been given the name *Bacterium marginatum* n. sp., and a technical description of it is given. The leaves attacked by this organism show elliptical lesions of rusty red which later become dull brown or purplish. These spots may occur on all parts of the foliage, but are more often confined to the lower leaves. The disease is said to make rapid progress during moist, warm weather, when the rot spreads widely and deeply into the tissues, often causing the collapse of the aerial part of the plant. This disease is said to be very prevalent in and about the District of Columbia, and evidence is presented showing that it occurs also in Illinois and probably in California.

A Phytophthora parasitic on peony, H. W. THURSTON, JR., and C. R. ORTON (*Science, n. ser., 54 (1921), No. 1391, pp. 170, 171*).—A description is given of a bud rot of peonies which is caused by a species of Phytophthora. The attention of the authors was called to this disease, and cultures made from infected material yielded a pure growth of a species of Phytophthora which has been studied to some extent. The organism was found to grow readily upon a variety of artificial media, differing in this respect from *P. infestans*. The measurements of the zoosporangia correspond closely to those of *P. infestans*, but they are somewhat broader than those of *P. thalictri*, which appears to be the closest relative so far as hosts are concerned. The disease is characterized as a necrotic condition of the buds, involving also the surrounding leaves and extending for several inches down the stem. In general appearance the symptoms are similar to those caused by Botrytis, although the affected area is dark brown or black.

Phytophthora erythroseptica as a parasite of Atropa belladonna, J. WESTERDIJK and A. VAN LUIJK (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 4 (1920), pp. 31, 32*).—*P. erythroseptica*, subjected to investigation here indicated, infected potato tubers. Roots of *A. belladonna*, though not infected in this series of studies, are thought to be subject to rot due to this fungus.

Arceuthobium oxycedri on Cupressus, E. HEINRICHER (*Ber. Deut. Bot. Gesell., 38 (1920), No. 6, pp. 220–223*).—Studies here noted show that *A. oxycedri* is able to infect, in addition to Juniperus, the genus Cupressus.

Hevea pink disease, F. VINCENS (*Bul. Agr. Inst. Sci. Saigon [Cochin China]. 2 (1920), No. 11, pp. 321–331*).—Pink disease (*Corticium salmonicolor*) of Hevea is said to be perhaps the worst disease of this tree in Indo-China. This brief account includes outlines of measures looking to prevention or treatment with Bordeaux mixture having concentrations of 1 per cent copper sulphate and 0.5 per cent lime. These are said to be fully as efficacious as the more expensive preparations in use, which contain 2 to 3 per cent of copper.

A canker of the white elm in Wisconsin, E. E. HUBERT and C. J. HUMPHREY (*Wis. Dept. Agr. Bul. 33 (1920), pp. 158–163, figs. 4*).—A peculiar die-back or canker of the branches of the white elm (*Ulmus americana*) has been observed in Madison, Wis., for a number of years, attacking shade and nursery trees and causing a characteristic dying of the upper crown and the individual

branches, and sometimes killing the tree. Most of the trees affected are from 15 to 20 years of age or over. During 1920 the disease developed with exceptional rapidity and virulence. Neglected trees are usually more heavily attacked. A fungus (*Sphaeropsis ulmicola*) is thought to be the causal organism.

Oïdium [affecting forests in France], F. Doé (*Rev. Eaux et Forêts, 57 (1919), No. 3, pp. 53–59*).—Oïdium appeared in the forests of France in portions indicated about 1907, attacking numerous growths but particularly injuring young oaks. The disease was severe in 1918, being associated with weather conditions and sequences described as apparently favorable to its progress.

Oak oïdium in the west of France, C. G. Aubert (*Rev. Eaux et Forêts, 57 (1919), No. 9, pp. 189–195*).—Referring to the statements by Doé as noted above, the author gives an account of the same sort of injury and danger in another part of the country. It appears that the oaks are able only under the best conditions to resist the fungus.

The Gloeosporiums of oak and sycamore, J. Westerdijk and A. van Luijk (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 4 (1920), pp. 3–21, figs. 16*).—The outcome is briefly indicated of studies with Gloeosporium on herbarium material and in pure culture, with descriptions of *G. quercinum* and *G. nervisequum*.

Gloeosporium ribis, A. van Luijk (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 4 (1920), pp. 22–25*).—A morphological study is detailed of *G. ribis* considered as the conidial form of *Pseudopeziza ribis*.

White pine blister rust control, S. B. Fracker (*Wis. Dept. Agr. Bul. 33 (1920), pp. 111–119, figs. 6*).—An account is given in some detail regarding the occurrence and prevalence of blister rust in Wisconsin and attempts to control the disease through removal of Ribes, the only means considered effective.

This work was carried on in cooperation with the Office of Blister Rust Control, U. S. Department of Agriculture, the fieldwork being in charge of J. W. Stephen in 1919, and under the direction of H. J. Ninman in 1920. The virulent nature of the disease has been fully demonstrated. Earlier stages of a similar condition were located in different sections. The disease is practically confined to Polk and adjoining counties, except for a few acres in Shawano County. No blister rust has yet been found in a Wisconsin nursery.

The disease is carried over in pine. Removal of Ribes for a distance of from 100 to 300 yards prevents its dissemination. Special crews have been assigned to the eradication of the woods infestations or escapes. Methods of destruction include removal of all the roots. This requires, in case of large bushes or clumps of bushes, the use of dynamite, which thoroughly loosens the soil and permits removal of all roots. The cost of eradication varies from 0.5 to 0.8 ct. per bush. On 10,995 acres the cost per bush was a little over 0.6 ct., or 46 cts. per acre.

Treatment of ornamental white pines infected with blister rust, J. F. Martin, G. F. Gravatt, and G. B. Posey (*U. S. Dept. Agr., Dept. Circ. 177 (1921), pp. 20, figs. 12*).—Experimental and practical results are said to have shown that ornamental pines which have become diseased can be saved by cutting out the infected parts if treatment is applied in time. Diseased twigs and branches should be cut off 7 in. or more back of the orange-yellow blisters. If no blisters are present they should be cut off 5 in. or more back of the extreme edge of the canker. Where large limbs and trunks are involved, all the diseased bark should be removed together with a strip of bark extending at least 2 in. wide at the sides and 4 in. at the ends of the apparently healthy bark, and the wounds should be covered with a suitable paint.

The treatment described above will protect the trees against the spread of the fungus, but primary infection should be barred against by the uprooting and destroying of all wild and cultivated currant and gooseberry bushes within 600 to 900 ft. of the trees.

[Wood rot prevention], F. Moll (*Centbl. Bakt. [etc.], 2. Abt., 51 (1920), No. 12–15, pp. 257–279*).—In a study of wood preservation employing the poisonous influence of inorganic salts it was found that the degree of poisonous action is an additive function of the ions, which as here named in the order of their effectiveness are mercury, silver, cadmium, cyanogen, copper, zinc, iron, cobalt, chromium, and fluorin. Most acid ions and the ions of the alkali metals, alkaline earths, magnesium, and aluminum appear to be practically without effect in this connection.

The poisonous quality depends upon solubility and ionization in water. The poisonous effect of the ions is not general but specific. Addition of other salts to poisonous substances may increase or decrease their ordinary effectiveness.

The employment with wood of mixtures of salts for the purpose of protection against rot and fire receives from the facts here noted a new justification.

Fungicidal and physiological action of fungicides, E. Pantanelli (*Azione Fungicida e Fisiologica degli Anticrittogamici. Rome: R. Staz. Patol. Veg., 1920, pp. 54*).—Studies and conclusions are detailed regarding the action of sprays in connection with fungi, in particular *Plasmopara viticola, Oïdium leucoconium, Fusarium niveum,* and *Botrytis cinerea.*

[The periodic system and fungicides], A. Wöber (*Ztschr. Pflanzenkrank., 30 (1920), No. 2–3, pp. 51–59, fig. 1*).—A discussion is given of the fungicidal effects of various elements in connection with their position and grouping in the periodic system.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Conserving our wild animals and birds, E. A. Goldman (*U. S. Dept. Agr. Yearbook 1920, pp. 159–174, figs. 9*).—The importance and methods of conservation of wild animals and birds are discussed in this popular account.

Hunting down stock killers, W. B. Bell (*U. S. Dept. Agr. Yearbook 1920, pp. 289–300, figs. 4*).—The importance of predatory enemies of live stock and the work being conducted under the direction of the Bureau of Biological Survey aimed at their control are summarized.

Death to the rodents, W. B. Bell (*U. S. Dept. Agr. Yearbook 1920, pp. 421–438, figs. 12*).—The crop-production loss occasioned by rodents is pointed out, and means applicable to their control are described in a popular manner.

Early annals of ornithology, J. H. Gurney (*London: H. F. & G. Witherby, 1921, pp. [5]+240, pls. 2, figs. 39*).—This book consists largely of information obtained in an investigation of the literature.

What bird is that? A pocket museum of the land birds of the Eastern United States arranged according to season, F. M. Chapman (*New York and London: D. Appleton & Co., 1920, pp. XXVI+144, pls. 8, figs. 9*).—The first part of this popular guide to the identification of land birds of the Eastern United States consists of eight colored plates as follows: (1) 19 permanent resident land birds of the Northern United States, (2) 21 additional permanent resident land birds of the Northern United States, and 23 winter visitant land birds of the Northern United States or those which come from the North in the fall and usually remain until spring, (3) and (4) 82 winter land birds of the Southern United States, (5) and (6) 34 early spring migrant land birds of the Eastern United

States, (7) and (8) 82 late spring migrant land birds of the Eastern United States. This is followed by descriptions and brief accounts of the species illustrated.

Farm help from the birds, W. L. McAtee (*U. S. Dept. Agr. Yearbook 1920, pp. 253–270, figs. 9*).—This is a popular summary of information as to food of birds, based upon records by the Bureau of Biological Survey.

[The food habits of Phasianus torquatus Gmel. in Colorado] (*Colo. Agr. Col. Circ. 31 (1921), pp. 31*).—The first part of this report consists of A Study of the Food Habits of the Ring-necked Pheasant, by W. L. Burnett (pp. 5–22), in which examinations were made of 48 birds. This pheasant is a native of southern Siberia, Korea, and northeastern China, that has been introduced into the United States. The investigations show it to be an omnivorous feeder, with grain its favorite food, and showing a decided preference for wheat, and that it is by no means the extremely insectivorous bird it has been supposed to be. Thus 8 young birds, taken in August, September, and October, had eaten 14 insects, 1,228 kernels of grain, and 1,235 seeds of weeds. Of these 8 birds, 5 had taken insects, 6 weed seeds, and 7 grain.

The Feeding Habits and Food of the Ring-necked Pheasant is reported upon by A. C. Maxon (pp. 23–31), based upon examinations of 12 male birds taken during the summer, fall, and early winter of 1916, at Longmont, Colo.

A general summary of the data presented in the two papers, by W. L. Burnett, leads to the conclusion that this pheasant by no means shows a preference for insect food and is very indifferent to grasshoppers. Only 11 live grasshoppers had been taken, and but 3 of the 60 birds had eaten cutworms.

Insect attacks reported or observed, B. A. Bourne (*Barbados Dept. Agr. Rpt., 1919–20, pp. 12–14*).—This discusses briefly the occurrence of the more important insects of the year.

Report of the entomologist, D. T. Fullaway (*Hawaii. Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1919–20, pp. 69–73, pls. 3*).—The acclimatization and establishment in Hawaii of *Pteromalus puparum*, an important pupal parasite of the imported cabbage butterfly, was again attempted, and its ultimate establishment is confidently expected. The establishment of the cockroach parasite *Dolichurus stantoni* is thought to be assured.

Reference is made to the infestation of the forest ferns by the fern weevil *Syagrius fulvitarsis*, an account of which has been noted (E. S. R., 42, p. 549).

Insect pests of farm, garden, and orchard, E. D. Sanderson and L. M. Peairs (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, 2. ed., rev. and enl., pp. VI+707, figs. 604*).—This is a second revised and enlarged edition, by L. M. Peairs, of the work by the senior author previously noted (E. S. R., 26, p. 752).

The diseases and animal pests of vegetable plants, J. Hartmann (*Die Krankheiten und Tierischen Schädlinge der Gemüsepflanzen. Leipzig: Hachmeister & Thal, [1919] pp. 54, pl. 1, figs. 32*).—This is a brief popular summary of information.

Some insects injurious to red clover, T. H. Parks (*Ohio State Univ. Ext. Bul., 16 (1920–21), No. 10, pp. 16, figs. 10*).—This is a popular summary of information on the more important insect enemies of red clover and means for their control.

Results of recent experimental work for the control of orchard insects, W. P. Flint (*Ill. State Hort. Soc. Trans., n. ser., 53 (1919), pp. 121–130, pl. 1*).—This is a brief summary of recent work on the control of San José scale, codling moth, and grasshoppers.

The highly toxic effect of chloropicrin upon certain lower animals, and the possibility of employing this substance for the destruction of insect pests, G. BERTRAND (*Compt. Rend. Acad. Sci. [Paris], 168 (1919), No. 14, pp. 742–744; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 7–9, pp. 1044, 1045*).—The preliminary investigations here reported indicate that fumigating or spraying with chloropicrin, either in the form of an aqueous solution or an emulsion, may prove a good method of controlling certain insect enemies of cultivated plants.

The cockchafer or hanneton, M. DECOPPET (*Le Hanneton. Genera: Libr. Payot & Co., 1920, pp. 130, pls. 51, figs. 8*).—The introduction to the papers here presented consists of a summary of the life of the cockchafer (*Melolontha* spp.). The first part of the work is devoted to a contribution to the study of the cockchafers, which consists of researches on their biology and appearance in the canton of Zurich (pp. 12–78). This is followed by an account of the destruction of white grubs in forest nurseries (pp. 79–91), which was first published in 1912 (E. S. R., 27, p. 662). A bibliography of five pages (pp. 92–96) and official orders, statistical data, tables, charts, and maps, recording the collection of cockchafers in the canton of Zurich, etc., are appended.

The South African locust poison, E. ANDERSON (*Union So. Africa Dept. Agr., Sci. Bul. 15 (1920), pp. 18*).—Investigations were conducted by the author with a view to determining what change or changes take place when treacle or sugar is added to the locust poison used in South Africa. This poison is made by dissolving 112 lbs. of sodium arsenite (80 per cent arsenic trioxid) in about 8 imperial gallons of water with the aid of heat, and making the solution up to 10 imperial gallons. The hot alkaline solution is added to 24 imperial gallons of crude mill treacle, refinery treacle, or strong sugar solution in a wooden barrel, thoroughly agitated, and then placed in metal drums of various sizes and sealed up. When these drums are opened in the field, a sludge is found to have formed in them which may have very different physical appearances.

Investigations show that both the sugar and soluble arsenic trioxid contents decrease on standing, and that these decreases are greatly augmented by mixing the solutions while hot, since the interaction between the reducing sugar and the arsenite is very rapid when locust poison is heated to the temperature of boiling water. It was found that the treacles caused chemical change chiefly in proportion to the extent to which they contained lime and invert sugars. The results have led to the recommendation that the solutions be cold at the time of preparation, and that the more dense arsenite solution be placed in the drum and afterwards the treacle or sugar solution, the mixing to wait until required for use.

A prepared grasshopper poison that is stored in drums in California has been described by Mackie (E. S. R., 44, p. 58).

Locust control in the Prairie Provinces, N. CRIDDLE (*Canada Dept. Agr., Ent. Branch Circ. 13 (1920), pp. 20, figs. 6*).—In addition to a general account of locust control in the Prairie Provinces of western Canada, there is an introductory account of The Outbreak of Locusts in Western Canada in 1919, by C. G. Hewitt, and accounts of outbreaks and control work in Manitoba by N. Criddle, in Saskatchewan by A. E. Cameron and M. P. Tullis, in Alberta by E. H. Strickland, and in British Columbia by R. C. Treherne.

Proceedings of the International Conference on the Organization of Locust Control Work (*Rome: Inst. Internatl. Agr., 1921, pp. 142*).—The proceedings of a conference held at Rome October 28 to 31, 1920, are reported.

The tarnished plant-bug as a potato pest, E. MOLZ (*Ztschr. Pflanzenkrank., 27 (1917), No. 7–8, pp. 337–339, figs. 2*).—The author records injury by this pest at Salzwedel, Germany, by its attack upon the potato vine.

Nicotin dust for grape leafhopper, F. K. Howard (*Calif. Cult., 56 (1921), No. 21, pp. 671, 678, fig. 1*).—In combating the grape leafhopper, tests of nicotin dust were conducted by the service department of the California Associated Raisin Company, assisted by R. E. Smith. Dusts carrying as high as 10 per cent of Blackleaf 40 in various combinations were used against the adults, but in all cases it was found that they were so active as to prevent satisfactory contact by these materials. Where the proper contact could be secured, dusts containing 5 per cent and more of Blackleaf 40 were found to actually kill the insect.

It is concluded that a large percentage of the wingless nymph hoppers can be cheaply and effectively killed. It is recommended that the materials used contain at least 5 per cent of Blackleaf 40, and that from 60 to 75 per cent of sublimed sulphur be added to combat mildew. The application should be made in such a manner that the dust is directed upward into the vines, since the young occur on the under surfaces of the leaves. The young hoppers are said to have commenced hatching May 1 in the Fresno district. The application should be made when the majority of the insects have hatched, and when as few as possible have reached the winged stage. It is thought possible that in the worst infestations two dustings may be necessary to catch all of the individuals of the first brood.

On the family name for the plant lice, A. C. Baker (*Ent. Soc. Wash. Proc., 23 (1921), No. 5, pp. 101–103*).—The investigations here reported have led to the conclusion that Linnaeus made a mistake in using aphids in the plural, and that the family name of the plant lice should be written Aphiidae and not Aphididae.

A biological study of the red date-palm scale, Phoenicococcus marlatti, A. D. Borden (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 659–668, pls. 4*).—This paper is based upon biological studies of *P. marlatti*, made by the Bureau of Entomology, U. S. Department of Agriculture, during monthly field inspections in the Coachella Valley, Calif., during the year 1920, with a view to determining the factors in its life history which may be of importance in the application of control measures.

The species was first discovered in this country by C. L. Marlatt at Washington, D. C., in 1890, on date palms imported from Algeria. It was described in 1899 as representing a new genus and species by T. D. A. Cockerell, who several years later found small colonies on palms in gardens at Tempe, Ariz. The infestations have since increased, and it has been brought in with practically all of the later introductions of offshoots into California and elsewhere, practically all of more than 10,000 imported palms in the Coachella Valley being now infested.

In severe infestations it has the habit of massing on the new succulent fruit stems and leaf bases of the palm in such numbers as to weaken greatly their normal development and cause a loss of the fruit. In the early spring during the migratory period the insects mass not only on the fronds but also on the fruit clusters and occasion serious damage. The main infestation on a mature palm is limited to the area extending 1.5 to 3 ft. below the crown, the crown tissues being free of scales, while lighter infestations continue on down the bole even to the ground.

"From July to April practically all of the scales are concealed beneath the leaf and fiber bases and on the fruit stems of the current year. The so-called spring migratory period of the scale is from April to June, and it is at this period that the new tissues and fruit stems become infested from the infested area of last year's fruit stems. The majority of the exposed generations of the

migratory periods out on the leaves are killed by the dry, hot weather following the migration, though some may persist in certain protected pinnae and reproduce a limited number of scales. The scale is found in all stages of development at all seasons of the year on the soft tissues of the leaf base and fiber band tissues. This indicates a continuous overlapping of generations. The duration of each generation is apparently from six to nine months."

"The most important means of distribution is through imported palms and offshoots from infested trees. These offshoots are invariably severely infested and carry the infestation through propagation to new plantings."

The protected position of the scale under the leaf bases and tight fiber bands makes control by spray or fumigant most difficult, since the spray must penetrate deeply between the fiber bands and leaf bases and applications be consistently repeated in order to reach the maximum number of scales. A spray consisting of liquor cresolis compositus, U. S. P., 1 part; distillate or kerosene, 4 parts; and water, 50 parts has been recommended, with four applications, from January 1 to February 15, from February 15 to April 1, from May 15 to June 30, and from July 1 to August 15, respectively.

Red date-palm scale, Phoenicococcus marlatti: A technical description, H. Morrison (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 669–676, pls. 4, fig. 1*).—Records by the Bureau of Entomology, U. S. Department of Agriculture, of the occurrence of this scale and technical descriptions of the several stages of both sexes are given, followed by a list of 26 references to the literature cited.

On the metamorphosis of the alimentary canal of Bombyx mori L., H. Ito (*Bul. Imp. Tokyo Sericult. Col., Japan, 2 (1920), No. 1, pp. 46, pls. 8*).—This is a report of studies conducted by the author which includes a bibliography of 19 titles.

[Control measures for the gipsy moth], A. F. Burgess (*North Jersey Agr. Soc. Proc., 1920, pp. 11–25, pls. 6*).—The author records the discovery, about July 1, 1920, of a large colony of gipsy moths at Somerville, N. J. Shipments from this point resulted in small infestations at Loretto Road, Pa., Garrison, Jamaica, and Roslyn, N. Y., and at several other localities in New Jersey, as previously noted (E. S. R., 45, p. 255). Infestations are also said to have been found at Flatbush, L. I., and Mendham, N. J., although positive evidence has not been secured that these resulted from shipments of stock from Somerville.

Some soil fumigation experiments with paradichlorobenzene for the control of the peach-tree borer, A. Peterson (*Soil Sci., 11 (1921), No. 4, pp. 305–318, pl. 1, fig. 1*).—This is a report of control work with the peach-tree borer conducted at the New Jersey Experiment Stations during 1919 and 1920, and carried on in connection with the sodium cyanid experiments previously noted (E. S. R., 43, p. 359).

The results obtained by the author with paradichlorobenzene are said to agree for the most part with those reported by Blakeslee in 1919 in a bulletin previously noted (E. S. R., 42, p. 54). This insecticide gives considerable promise of becoming a valuable and important means for the control of the peach-tree borer, although its use is still in the experimental stage. The author suggests that peach growers try out this method for a year or two on a small block of trees six years of age or older before treating their entire planting of old trees.

It is pointed out that it is not a "fool-proof" remedy, but that certain points in its use must be carefully followed. From 0.75 to 1 oz. will kill 90 to 100 per cent of the borers if the soil temperature is 55 to 60° F. or higher and the soil is not too wet. "It can be used with a considerable margin of safety on trees six years of age or older. In making applications the finely divided

crystals are evenly distributed in a narrow continuous circular band on smooth ground about the base of the tree. The band should be approximately 2 in. from the tree and no crystals should be closer than 1 in. from the tree. In case there are indications of borers in the tree 1 to 6 in. above the ground, the best results are obtained if the soil is mounded about the tree so that the upper level of the soil is even with the highest point where the gum, containing sawdust-like particles, is exuding from the tree. The application should then be made on a new soil level. After the paradichlorobenzene is properly distributed place several shovels of dirt, free of weeds, grass, large stones, sticks, etc., over the 'death ring' of crystals and pack down the dirt with the back of a shovel or some other tool. For New Jersey conditions the best time of the year to make applications is during the last week in August or the first 10 days in September, August 25 to September 10."

Preliminary note on the infestation of Hibiscus esculentus pods by the pink bollworm, L. H. Gough (*Bul. Soc. Ent. Égypte, 11 (1918), No. 4, pp. 79–83*).—Tables are given which show the percentage of infestation of okra by the pink bollworm at various periods of 1918 and the emergence of the moths from *H. esculentus* pods and seeds.

The European corn borer in American corn, W. R. Walton (*U. S. Dept. Agr. Yearbook 1920, pp. 85–104, figs. 8*).—This is a popular summary of information.

The European corn borer, H. G. Crawford (*Sci. Agr., 1 (1921), No. 3, pp. 126–130, figs. 2*).—This account includes a map of western Ontario showing the area scouted for corn borers in 1920 and the townships found infested. A chart is given which indicates the distribution of infestation and consequent damage by the pest in a flint cornfield at Union Village, Ont., in 1920.

Boring caterpillars affecting corn and other crops and which are liable to be mistaken for the European corn borer, A. Gibson (*Canada Dept. Agr., Ent. Branch Circ. 14 (1920), pp. 14, figs. 7*).—Following a description of the European corn borer, the author reports on the burdock borer (*Papaipema cataphracta* Grt.), the stalk borer, the potato-stem borer (*Gortyna micacea* Esp.), a western corn borer (*Helotropha reniformis atra* Grt.), a new eastern corn borer (*Apamea nictitans americana* Spey.), the bollworm or corn earworm, the spindle-worm (*Achatodes zeae* Harr.), the glassy cutworm (*Sidemia devastator* Brace, and the parsnip webworm (*Depressaria heracliana* De G.).

Notes on an Ephestia, an insect injurious to stored dates in Khargeh Oasis, L. H. Gough (*Bul. Soc. Ent. Égypte, 10 (1917), No. 4, pp. 133–140+[3], pl. 1*).—This is a brief account of an Ephestia, the larvæ of which feed in the dates and reduce the value of the fruit. "Up to the present the oasis Ephestia has chiefly been recorded from dates grown in Khargeh and Dakhleh Oases. Dates obtained from Salhieh, in the northeast of the Delta, were found to be attacked by *E. calidella* and by *E. cautella*. The larvae of both these species differ in their habits from the oasis Ephestia. . . . In both cases the resting stage is passed as larvae, not as pupae nor as eggs, and in both cases the larvae spin cocoons in which they remain during their resting stage."

Cure for iris borer, W. N. Clute (*Flower Grower, 8 (1921), No. 2, p. 33*).—The iris borer, which is found in most species of iris and closely related plants like the blackberry lily, lays its eggs in autumn on the old leaves of the iris. The larva hatches out in the spring bores down through the sheaf of leaves, and soon establishes itself in the rootstock, where it is almost impossible to reach it. The best remedy is said to consist in burning over the iris beds in early spring before it has gained access to the rootstock. Burning of a thin cover of dead weeds raked over the irises, when the wind is right, is said to be sufficient to destroy the borer.

The mosquitoes of Canada, H. G. DYAR (*Roy. Canad. Inst. Trans., 13 (1921), No. 29, pp. 71–120*).—This includes a key to the tribes and genera of Canadian mosquitoes, descriptions of the genera and species with records of their occurrence in Canada, and tables for their separation.

Anopheles and sea water, with observations on the influence of salinity on the development of American species, T. H. D. GRIFFITHS (*Pub. Health Rpts. [U. S.], 36 (1921), No. 18, pp. 990–1000*).—"*A. crucians* was found to propagate in sea water diluted to a maximum salinity of 10,088, or slightly more than 50 per cent average sea water. The transfer of *A. crucians* larvae which had started their development in brackish water to sea water did not unfavorably affect their subsequent development.

"*A. quadrimaculatus* was not found to breed in numbers sufficient to be of sanitary importance in a higher salinity than 10,003, or 1.5 per cent sea water. In one case two larvae found in water with a salinity of 10,048 developed into *A. quadrimaculatus* imagoes, but this observation requires confirmation as to whether this species may complete its entire water cycle in so high a percentage of sea water. The question is raised as to whether *A. quadrimaculatus* larvae may not withstand a much higher salinity intermittently than continuously. Specimens of *A. quadrimaculatus* transferred from fresh pond water to sea water, salinity 10,160, were all killed within 12 hours.

"*A punctipennis* was not found developing in salt or brackish waters. This species breeds under a wider range of conditions than either *A. quadrimaculatus* or *A. crucians*, but apparently does not survive in salt of brackish waters. Larvae of *A. punctipennis* all died within 7 hours when put into sea water."

District of Columbia Diptera: Scatopsidae, W. L. MCATEE (*Ent. Soc. Wash. Proc., 23 (1921), No. 5, pp. 120–124*).

Dispersion of flies by flight, F. C. BISHOPP and E. W. LAAKE (*Jour. Agr. Research [U. S.], 21 (1921), No. 10, pp. 729–766, pl. 1, figs. 2*).—This is a report of the investigations conducted by the Bureau of Entomology, U. S. Department of Agriculture, in northern Texas during the summers of 1916 and 1918, with a view to securing some definite facts as to the tendencies and possibilities of dispersion of injurious species under rural conditions. In discussing previous work reference is made to the experiments of Copeman et al. in Great Britain (E. S. R., 30, p. 658), and Parker in Montana (E. S. R., 36, p. 56), and to the observations of Hodge on Lake Erie (E. S. R., 30, p. 159), and of Ball off the coast of Florida (E. S. R., 39, p. 860).

The results obtained in the trapping of marked flies at distances of from 4 to 17 miles from approximately 234,000 that were released have shown the maximum distance of spread from the point of release to be as follows for the several species: *Musca domestica* 13.14 miles, *Chrysomya macellaria* 15.1 miles, *Phormia regina* 10.9 miles, *Lucilia sericata* 1.2 miles, *L. caesar* 3.5 miles, *Synthesiomyia brasiliana* 0.5 mile, *Sarcophaga* spp. 3 miles, *Ophyra leucostoma* 7 miles, *O. aenescens* 4.1. miles. In these tests it is considered that too few individuals of species other than *M. domestica*, *C. macellaria*, and *P. regina* were liberated to form a reliable guide to their dissemination tendencies.

"Marked flies of all species dispersed in all directions from the point of liberation. Among the stimuli inducing dispersions the desire for food and the desire for places for oviposition appear to be among the strongest.

"The fact that many towns, farmhouses, and other favorable feeding and breeding grounds were passed by the flies shows that *M. domestica*, *C. macellaria*, and *P. regina* at least are not satisfied by the mere finding of these places, but have marked migratory habits. *C. macellaria* evinces stronger tendencies toward migration than does *M. domestica*. This tendency in *P. regina* under optimum climatic conditions for the species is probably equal to that in *C.*

macellaria. The other species were liberated in numbers too few for conclusions to be drawn, but *O. leucostoma* and *O. aenescens* show marked ability to travel considerable distances.

"The exact relation between direction of dispersion and direction of wind could not be determined from the results of these experiments because of the choppy wind conditions experienced. There appears to be a tendency for *M. domestica* and *C. macellaria* to go with the wind in greatest numbers, but they are shown to travel against and at right angles with it as well. It is concluded that under natural conditions the influence of moderate winds on dissemination is not of great importance. The evidence gained justifies the conclusion that the passing of vehicles along the highways was not a dominating factor in the dispersion of any species of flies in these tests. This does not mean, however, that flies under other conditions may not be widely scattered by artificial means.

"These tests show that the house fly, screw-worm fly, and black blowfly spread rapidly for many miles. *C. macellaria* was recorded about 8 miles from the point of liberation in less than 24 hours and 10 miles in less than 48 hours after liberation. *P. regina* was recovered about 11 miles away in less than 48 hours after release. *M. domestica* was recovered over 6 miles from the point of release in less than 24 hours. Males as well as females of the principal species used in these experiments may travel many miles.

"The maximum longevity of the marked flies after liberation as shown by the records of capture was: *M. domestica* 15 days, *C. macellaria* 17 days, *P. regina* 10 to 11 days, *O. aenescens* 6 to 8 days, *Sarcophaga* spp. 11 to 12 days. While in the fourth experiment no marked flies were captured in the more distant traps (about 17 miles from the point of release), it is the author's belief that the limits of dispersion were not reached in that test, and that where great numbers of flies are emerging constantly the distance traversed may be much farther than the maximum here determined. The facility with which flies travel many miles emphasizes the importance of the general application of sanitary measures looking toward the suppression of fly breeding."

A comparison of the cabbage maggot control test at the market-garden field station in 1918 and 1920 (*Mass. Agr. Col., Mo. Jour. Ext. Work for Market Gardeners, No. 34 (1921), pp. 3, 4*).—The use of tar-felt disks in the control of the cabbage root maggot by certain market gardeners near Boston, who have accepted this practice as necessary to grow a successful early cabbage crop, led to the tests here recorded.

The results have led to the conclusion that tar-felt disks, applied the same day the plants are set, will practically insure protection if they are put on correctly. At a cost of $2 to $2.50 per 1,000, and of $1 per 1,000 for their application, the expense for 7,000 plants per acre is about $24.50 per acre. With the gain resulting, which amounted to nearly 2 tons per acre, their application on early cabbage ought to be a paying proposition, since at 1 ct. per pound there would be a return of the original cost plus a 50 per cent dividend.

A naturalist on Lake Victoria, with an account of sleeping sickness and the tsetse fly, C. D. H. Carpenter (*London: T. Fisher Unwin, Ltd., 1920, pp. XXIV+333, pls. 56, figs. 2*).—This work includes much data of interest to the economic entomologist, mammalogist, and ornithologist, in addition to the discussion of the tsetse fly and its relation to sleeping sickness.

The greyback beetles, J. F. Illingworth (*Aust. Sugar Jour., 13 (1921), No. 1, pp. 72, 73*).—Attention is called to the fact that the greyback beetle, an enemy of sugar cane in Australia, should be known as the *Lepidoderma albohirtum*.

Special investigations of the life history, etc., of Phytalus smithi (Arr.) under Barbados conditions, B. A. BOURNE (*Barbados Dept. Agr. Rpt., 1919–20, pp. 18–31, figs. 2*).—Included in this report of investigations conducted are descriptions of the stages in the life cycle of *P. smithi*, insectary methods of study, an account of its life history and habits including data in tabular and chart form, and an account of its natural control.

The cane beetle borer in Fiji, Rhabdocnemis obscura Boisd., R. VEITCH (*Colon. Sugar Refining Co. [Fiji], Agr. Rpt., 4 (1919), pp. 23, figs. 7*).—This is a summary of information on the present status of this pest in Fiji and means for its control.

The Colorado potato beetle and its control, M. H. SWENK (*Nebr. Potato Impr. Assoc. Ann. Rpt., 1 (1919), pp. 49–57, fig. 1*).—It is said that the Colorado potato beetle has occurred injuriously for many years over all of eastern Nebraska east of the ninety-seventh meridian, as well as west to Frontier and Hitchcock Counties south of the Platte River and west to Keya Paha County in the Niobrara Valley. Over the remainder of the State, particularly in the important potato-growing districts of western Nebraska, it was not a very important pest, though present in small numbers, prior to 1919, in which year it became quite common and in the Box Butte region, at least, was the cause of more or less serious injury. The beetle is said to be normally two-brooded in the latitude of Nebraska.

The life history of Epilachna dodecastigma Muls. in Delhi, J. E. A. DEN DOOP (*Teysmannia, 30 (1919), No. 6, pp. 243–253, pl. 1*).—An account of studies of the lady beetle *E. dodecastigma*, which is a source of injury to the potato and cucurbits.

Killing boll weevils with poison dust, B. R. COAD (*U. S. Dept. Agr. Yearbook 1920, pp. 241–252, figs. 2*).—A popular summary of information based upon investigations, a summary of the present status of which has been previously noted (E. S. R., 43, p. 856).

Bee culture in Virginia (*Va. Dept. Agr. and Immigr. Leaflet 6 [1921], pp. 5*).—A brief popular account.

Report of the State apiarist for the year ending October 31, 1918, F. E. MILLEN ET AL. (*Iowa State Apiarist Rpt., 1918, pp. 68, figs. 11*).—This report of the State apiarist includes a number of papers on different phases of beekeeping, including one on The Evolution of Beekeeping Practice in the United States, by G. S. Demuth (pp. 53–62) and another on The Importance of Bee Behavior in Practical Beekeeping, by E. F. Phillips (pp. 62–68).

Report of the State inspector of apiaries, L. E. MATTESON (*Ariz. State Insp. Apiaries Rpt., 1920, pp. 14*).—This is a report of inspection work of the year, the details of which are presented in tabular form.

Notes on the distribution and bibliography of North American bees of the families Apidae, Meliponidae, Bombidae, Euglossidae, and Anthophoridae, F. E. LUTZ and T. D. A. COCKERELL (*Bul. Amer. Mus. Nat. Hist., 42 (1920), pp. 491–641*).—This includes records of interest to the economic entomologist.

Studies of ants, I, A. FOREL (*Le Monde Social des Fourmis du Globe Comparé à Celui de l'Homme. Geneva: Libr. Kundig, 1921, pp. XIV+192, pls. 3, figs. 31*).—In this, the first of five volumes, the author deals with the phylogeny, ontogeny and polymorphism, external anatomy, internal anatomy, classification, geographical distribution, and fossil ants.

Hornets and other social wasps (*Sci. Amer. Mo., 3 (1921), No. 4, pp. 307–310, figs. 8*).—This is a discussion of nest building and community life among the Vespidae.

Correlation of taxonomic affinities with food habits in Hymenoptera, with special reference to parasitism, C. T. Brues (*Amer. Nat., 55 (1921), No. 637, pp. 134–164*).—This discussion includes a bibliography of five pages.

A list of cecidia reported from Egypt up to the present time, B. Dçbski (*Mém. Soc. Ent. Egypte, 1 (1918), No. 4, pp. 38*).—The first part of this paper includes a bibliography of five pages; the second part consists of a list of host plants and their cecidia.

Control of red mite on fruit trees, W. K. Dallas (*New Zeal. Jour. Agr., 22 (1921), No. 3, pp. 171–174*).—The results of the work during the season are said to confirm those obtained the preceding year, namely, that lime sulphur has apparently no detrimental effect on the hatching of red-mite eggs, but that it is effective against live mites, the infestation in all cases being much reduced compared with what it was when the experiments began. It was observed that the mites were more readily controlled by lime sulphur where the trees, during their dormant period, had received an oil spray.

"Careful examination of the trees in plats 1 and 2 indicates that Gargoyle, 1:60, plus 2.5 lbs. soap, is more effective than Federation oil 1:80, plus 2.5 lbs. soap. Gargoyle heated to 120° F. (dormant spray) was very effective. It was observed on examination after the heated oil was applied that a large percentage of the red-mite eggs had turned white. Of the seven plats treated, this one is easily the freest from the pest.

"Calsulph lime sulphur has been effective. Caustic soda, 1:10 dormant spray, while being very effective against mussel scale, did not appear to have any effect upon red-mite eggs."

FOODS—HUMAN NUTRITION.

Food for farm families, H. W. Atwater (*U. S. Dept. Agr. Yearbook 1920, pp. 471–484*).—Farm diets are discussed on the basis of 500 studies made by the Office of Home Economics in cooperation with the Bureau of Markets in 41 States among people of 16 nationalities, 73 being farm families. A larger total weight of food, freer use of animal foods, chiefly milk, and of vegetables and fruits were noted for the farm families. "There can be no doubt that the food eaten on the average American farm is abundant, wholesome, and varied enough for health and enjoyment. Common observation and accurate studies all indicate that, in general, no large group of the population is better nourished or secures its food so cheaply as the farm families of the United States."

Studies on the digestibility of proteins in vitro.—I, The effect of cooking on the digestibility of phaseolin, H. C. Waterman and C. O. Johns (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 9–17*).—To determine whether the better results obtained with cooked than with raw navy beans in the feeding experiments previously reported (E. S. R., 42, p. 756) were due to greater digestibility of the protein through cooking, digestion experiments in vitro were conducted with raw and cooked phaseolin. The samples were digested with pepsin in N/10 acid at 37° C., the acid neutralized, and the digestion continued with trypsin in 0.5 per cent Na_2CO_3 or in N/20 NaOH. At the end of the digestion period the activity of the enzyms was destroyed by heating in a steam bath at 80° for 5 minutes, and the extent to which proteolysis had proceeded was determined by estimations of the amino nitrogen in 10 cc. aliquots from the filtered reaction mixtures, correction being made for all reagents used.

The results obtained indicate that phaseolin is rendered more readily digestible by boiling with distilled water. Cooking for 5 minutes gave a noticeable increase in digestibility, and cooking for 45 minutes produced the maximum effect.

Does growth require preformed carbohydrate in the diet? T. B. OSBORNE and L. B. MENDEL (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 5, pp. 136, 137*).—The authors report briefly that rats receiving a diet in which the amount of digestible carbohydrate is exceedingly small can grow from an early age to adult size. The rations fed in the experiments from which these conclusions are drawn included protein in the form of casein, edestin, or lean beef thoroughly extracted with boiling water, inorganic salts, agar, lard, butter fat, and 0.4 gm. daily of dried brewery yeast as a source of vitamin B.

Growth on diets containing more than 90 per cent of protein, T. B. OSBORNE and L. B. MENDEL (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, No. 167, 168*).—Following the authors' successful experiences in growing rats on foods extremely poor in carbohydrates, as noted above, or in fats (E. S. R., 45, p. 164), similar experiments were conducted using diets containing only minimal quantities of both carbohydrate and fat. The mixtures included protein 95 per cent and inorganic salts 5 per cent, together with vitamins A and B in the form of tablets of alfalfa (0.4 gm.) and dried brewery yeast (0.2 gm.) daily. On these diets, with casein furnishing the protein, the experimental animals have already grown to three times their weight at the beginning of the experiment.

Studies on the inorganic constituents of milk.—I, Chlorids in human milk, W. R. SISSON and W. DENIS (*Amer. Jour. Diseases Children, 21 (1921), No. 4, pp. 389–400, fig. 1*).—A study of the chlorin content of 327 specimens of human milk by the McLean-Van Slyke titration method (E. S. R., 34, p. 507) is reported.

The results obtained indicate that the salt content of human milk is subject to great variations during all periods of lactation. The average chlorin concentration of milk from all types of women at all periods of lactation was 58.2 mg. per 100 cc. of milk. The average after the second week of lactation was 52.6 mg. Normal mothers giving large amounts of milk showed a minimum variation in the chlorin concentration of their milk, with an average of 38.1 mg. Diet was apparently without effect on the chlorin concentration of the milk.

A souring of beef caused by Bacillus megatherium, H. BUNYEA (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 689–698, figs. 2*).—A bacteriological and chemical investigation of the cause of the phenomenon known as sour beef is reported from the Bureau of Animal Industry, U. S. Department of Agriculture. From a specimen of sour beef sent from one of the large packing houses were isolated three organisms, two of which proved to have no significance. The third, which was found to be responsible in pure culture for the souring of beef, was identified as *B. megatherium*. This organism was found capable of souring beef with the production of propionic acid under a wide range of temperatures but not in the absence of oxygen. It proved nonpathogenic for experimental animals (rabbits and guinea pigs), and did not produce an appreciable amount of toxin when propagated upon raw beef.

The effect of raw onions on gastric digestion, E. WILBRAND (*München. Med. Wchnschr., 67 (1920), No. 41, pp. 1174, 1175, fig. 1*).—Following observations on the favorable effect of raw onions on the course of intestinal catarrh and dysentery, the author conducted experiments on dogs with gastric and duodenal fistulas to observe the effect upon the amount of secretion and its acidity of the addition of raw onions to a basal ration of potatoes. The results obtained led to the conclusion that the favorable action of the onions is due to an increase in acidity and an increased secretion of the gastric juice.

Bromin existing normally in animal tissues, A. DAMIENS (*Bul. Soc. Chim. Biol., 3 (1921), No. 3, pp. 95–104*).—Essentially noted from another source (E. S. R., 44, p. 713).

The causes of variation in the content of zinc in vertebrates: Influence of age, G. BERTRAND and R. VLADESCO (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 12, pp. 768–770*).—As part of an investigation of the causes of variation in the content of zinc in the same organs of different animals of the same species noted in a previous study (E. S. R., 45, p. 367), a study has been made of the amount of zinc in several vertebrates, including mice, rabbits, guinea pigs, and chickens at different ages. The general conclusion drawn from the results obtained is that the proportion of zinc is greatest soon after birth, diminishes gradually, remains fixed around a minimum until old age, and then increases.

The water-soluble B vitamin content of certain vegetables, G. C. DUNHAM (*Military Surg., 48 (1921), No. 2, pp. 223–234, figs. 8*).—The vitamin B content of various vegetables was determined as follows: Albino rats from 4 to 5 weeks old were fed ad libitum a basal ration of casein 20, starch 61, butter fat 15, and salt mixture 4 per cent until growth had ceased and in some cases a slight decrease in weight had occurred. The air-dried and pulverized vegetable to be tested was then fed in decreasing amounts apart from the daily ration until the weight became constant at some point between 75 and 100 gm., when the rat was 100 to 130 days old. The feeding of the ration thus adjusted to maintain a constant weight was continued for 30 days, during which time the weight should remain constant with an allowable variation of ±4 per cent. At the end of this period 500 mg. daily of dried yeast was added to the diet in place of the substance tested. Immediate restoration of growth indicated that the lack of growth was due to insufficiency of vitamin B.

As tested thus the daily dosage in milligrams of the vegetable food products examined was as follows: Baker's yeast 50, potato raw 65, potato boiled with skins 95, potato boiled without skins 125, potato baked 100, spinach boiled 85, cabbage raw 70, cabbage boiled 95, carrots raw 70, carrots boiled 105, turnips boiled 105, peas canned uncooked 115, and peas canned with boiling 125 mg. A comparison of the raw and cooked foods showed that some of the vitamin is extracted by the cooking water and lost when this water is discarded, as was the case in the experiments reported.

The nutritional requirements of yeast.—III, The synthesis of water-soluble B by yeast, V. E. NELSON, E. I. FULMER, and R. CESSNA (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 77–81, fig. 1*).—Continuing the investigation previously noted (E. S. R., 45, p. 565), evidence has been obtained that baker's yeast can synthesize vitamin B. Yeast which had been growing continuously for a year, as described in the previous paper, was air-dried and used as a source of vitamin B in feeding experiments with rats on a diet of casein 18, salt mixture 5, butter fat 5, and dextrin 72 per cent. The addition of 2 per cent of the yeast grown on the synthetic ration proved sufficient to promote rapid growth in animals declining on the basal ration.

Vitamins and yeast growth, R. J. WILLIAMS (*Jour. Biol. Chem., 46 (1921), No. 1, pp. 113–118, fig. 1*).—The author reports determinations by the yeast method (E. S. R., 43, p. 614) of the vitamin content of the materials selected by Osborne and Mendel for the determination of their content in vitamin B by the use of growing rats (E. S. R., 42, p. 759). Water extracts of the materials were used in two dilutions, one twice as concentrated as the other, and the value of the material in question was expressed in milligrams of yeast which would be produced under given conditions from the extract of 1 gm. of the material.

In commenting upon the method, it is noted that a proportionality between growth produced and vitamin added is obtained only when a very small seeding of yeast is used and the initial growth is measured. If a larger amount of

yeast is used for seeding and growth is allowed to go to completion, increasing vitamin content in some cases was found to have a distinct retarding effect. This is thought to explain the contrary results obtained by Fulmer et al. (E. S. R., 45, p. 565). An exception to this was noted in the case of cabbage, new potatoes, spinach, carrots, and sprouted barley, the higher concentrations yielding better results. Since these substances are good sources of vitamin C, the suggestion is offered that vitamin C as a secondary factor may stimulate yeast growth.

The results obtained are in general considered to be in satisfactory agreement with those obtained by Osborne and Mendel. "Bakers' yeast, however, by the yeast method shows a much higher vitamin content than brewers' yeast, whereas by animal-feeding experiments here reported brewers' is found much richer. A bakers' yeast extract is found to be richer as regards the growth of bakers' yeast than a brewers' yeast extract. A brewers' yeast extract, however, is richer in affecting the growth of brewers' yeast than a bakers' yeast extract. This is interpreted to mean that there is some specificity in growth stimulants, but not necessarily two totally different substances stimulating the growth of the two varieties of yeast."

Some observations on the stability of the antiscorbutic vitamin and its behavior to various treatments, N. R. Ellis, H. Steenbock, and E. B. Hart (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 367–380, figs. 13*).—In this preliminary work on the properties of the antiscorbutic vitamin, the authors report that the desiccation of cabbage in an atmosphere of CO_2 for 35 hours at 65° C. destroys the vitamin. The fermentation processes involved in the making of sauerkraut from cabbage and silage from corn also result in the destruction of vitamin C. The vitamin was not removed from orange juice by ether or by aeration, but was destroyed by oxidizing agents such as hydrogen peroxid and potassium permanganate. Blood charcoal and the Chamberland filter removed a considerable amount but not all of the vitamin from the orange juice.

Accidents of the scorbutic type in animals on a normal diet, but submitted to the action of thyroid extract, G. Mouriquand and P. Michel (*Compt. Rend. Soc. Biol. [Paris], 84 (1921), No. 1, pp. 43–45*).—A study of the effect of alteration of the metabolism of guinea pigs through administration of thyroid extract is reported, with the following results:

Animals on a scorbutic diet of 30 gm. barley plus 10 gm. of barley dried for 48 hours at 37° C. died in 50 days with marked scorbutic lesions. Others submitted to the same diet plus 0.0005 gm. thyroid extract died in 15 to 18 days with more or less intense scorbutic lesions of the bones (friability of bones, softening of the vertebrae, and vacuolated appearance of the epiphyses). Another group of animals which had been maintained in good health on a normal diet was continued on the same diet with the addition of from 0.00025 to 0.0005 gm. of thyroid extract. All on this diet succumbed in from 13 to 31 days with lesions of the scorbutic type. These animals, although consuming a daily ration capable of maintenance and even growth, died in a state of great emaciation. In still another group fed a richly antiscorbutic diet plus the thyroid extract, two of the animals died in 14 and 21 days, respectively, without lesions of the bones, while another presented lesions of medium intensity. In a final group fed an antiscorbutic diet plus very small amounts of thyroid extract, one died in 71 days after a loss in weight of 35 per cent and with acute symptoms of scurvy.

The conclusion drawn is that it is possible to obtain in guinea pigs lesions of a scorbutic type, similar to those provoked by a vitamin-poor ration, by the addition of thyroid extract to a complete antiscorbutic ration, the lesions seeming to depend in part at least upon a considerable increase in metabolism.

Antiscorbutic potency of milk powders, E. B. Hart, H. Steenbock, and N. R. Ellis (*Jour. Biol. Chem., 46 (1921), No. 2, pp. 309–318, figs. 12*).—A study is reported of the relative antiscorbutic potency of milk powders prepared by the three processes followed in this country: (1) The Merrell-Soule or spray process; (2) the spray process, developed at the California Central Creameries, in which the milk is not condensed before being dried and the powder is cooled and removed a few seconds after being dried; and (3) the Just process, involving the drying of the milk on heated rolls. The powders were used in guinea pig feeding experiments as 40 per cent of a ration containing in addition 40 per cent of rolled oats, 19 per cent of heated alfalfa flour, and 1 per cent of NaCl.

With allowances for the factor of the initial quantity of vitamin C in the milk as influenced by feed, the powders were found to vary in their potency with the process used in their manufacture, the spray processes being more destructive than the Just process. "These results should in no way condemn the milk powders made by spray processes. They only point out their limitations when used as the sole source of nutrients in infant feeding.

"Probably with all milk powders, irrespective of method of manufacture, the safest procedure in a restricted dietary, particularly in infant feeding, is to supplement them with some potent source of the antiscorbutic vitamin. A possible exception to this statement would apply to the powders made by the Just process from summer-produced milks, or even winter-produced milks where the cow's ration is made rich in the antiscorbutic vitamin by the proper selection of roots and tubers."

Infantile scurvy following the use of raw certified milk, H. K. Faber (*Amer. Jour. Diseases Children, 21 (1921), No. 4, pp. 401–405*).—A case of scurvy is reported in an infant fed from birth on modified, raw, certified milk to which small amounts (a total of about 0.84 gm. daily) of sodium citrate had been added. While definite proof was not obtained that the sodium citrate destroyed the antiscorbutic vitamin of the milk, the author is of the opinion that the use of sodium citrate in infant feeding over long periods should provisionally be regarded as dangerous.

The menace of scurvy in Vienna, H. Chick and E. J. Dalyell (*Wiener Klin. Wchnschr., 32 (1919), No. 51, pp. 1219, 1220*).—The authors discuss briefly the presence of scurvy in Vienna (1919) among infants and young children. The epidemic is thought to be largely the result of the lack of fresh milk or of repeated heating of the fresh milk on account of transportation difficulties.

A dietetic production of rickets in rats and its prevention by an inorganic salt, H. C. Sherman and A. M. Pappenheimer (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, pp. 193–197*).—A brief report is given of observations which demonstrate that rickets may be caused or prevented without change in either the protein or vitamin components of the diet and, therefore, that neither of these can be regarded as a necessarily predominating factor.

The histological criteria for the diagnosis of rickets, as based upon the microscopic examination of ribs and femora partially decalcified in Mueller's fluid, and in some cases confirmed by X-ray examination, were as follows: "(1) The great increase in width of the zone of growing cartilage, and its irregular projection toward the diaphysis; (2) the failure of calcium deposition in the zone of preparatory calcification; and (3) a pronounced increase in the osteoid margin, both in the region of the metaphysis and along the shafts of the bones."

In the authors' experience the calcium content of the body of growing rats increases at a greater rate than the body weight until at about 4 months the adult percentage, 1 to 1.25 per cent, of the body weight is reached, after which

the weight of body and weight of calcium continue parallel until growth is complete. In rats placed at weaning on a diet of patent flour and sodium chlorid, both body weight and calcium ceased to increase and the animals died in about 6 weeks, showing multiple fractures, marked deformity of the thorax, and osteoporosis, but not typical rickets. On a diet of patent flour 95, calcium lactate 3, and sodium chlorid 2 per cent, or on a similar diet with the substitution of 0.1 per cent ferric citrate for its equivalent in calcium lactate the rats showed little or no growth in body weight, but a sufficient gain in calcium to make the percentage of calcium after from 4 to 6 weeks about the same as that of a normal animal of the same age. All of the animals on this diet showed true rickets. With all other conditions the same, with the exception of the substitution of 0.4 per cent of potassium phosphate for the same amount of calcium lactate, an increased assimilation of calcium resulted and rickets was prevented.

A study of the relation of family income and other economic factors to pellagra incidence in seven cotton-mill villages of South Carolina in 1916, J. Goldberger, G. A. Wheeler, and E. Sydenstricker (*Pub. Health Rpts. [U. S.], 35 (1920), No. 46, pp. 2673–2714, fig. 1*).—This paper, in continuation of the detailed report of the pellagra investigation in South Carolina previously noted (E. S. R., 43, p. 863), deals with the relation of conditions of an economic nature to the incidence of the disease.

Among the many economic factors which had an important influence on the incidence of pellagra, family income and food available proved the most potent. In general the pellagra incidence varied inversely with the family income. Differences in incidence among villages whose households were economically similar were attributable to differences in availability of food supplies resulting from differences in the character of the local markets, in the produce from the adjacent farm territory, and in marketing conditions.

An experimental study of avian beriberi, G. M. Findlay (*Jour. Path. and Bact., 24 (1921), No. 2, pp. 175–191, fig. 1*).—A comparative study of avian beriberi and inanition in pigeons and fowls is reported in clinical and histological observations, together with similar observations of normal controls.

The main clinical symptoms of avian beriberi as distinguished from the effects of inanition were all referable to a functional paralysis of the central nervous system. The histological changes were similar in gross manifestations to those of inanition, including hypertrophy of the adrenals, little or no change in the pituitary glands, and atrophy of the other organs. Microscopically they differed from those of inanition in evidence of nuclear degeneration, chromatolysis in the cells of the nervous system, and retention of lipoids in the adrenal cortex.

The nucleic acid content of the organs of the ox was found to be related quantitatively to the vitamin B content of the same organs as determined by Cooper (E. S. R., 28, p. 760). Similarly the liver and brains of birds with beriberi showed a decrease in nucleic acid content, which was more marked in the liver than in the brain. The administration of vitamin B in the form of yeast to birds suffering from beriberi was followed by the removal of lipoids from the adrenal cortex, an increase in the nucleic acid content of the brain, the reappearance of the Nissl granules, and the disappearance of the paralytic symptoms.

On the basis of these findings the author advances the theory that "vitamin B is essential for the formation of nucleic acid. When the tissue content of vitamin B falls below a certain level the phosphorized lipoid, instead of passing on to the central nervous system, is immobilized in the adrenal cortex;

the central nervous system begins to run short of nuclear material, and a functional paralysis occurs. If the nuclear shortage becomes very acute, the essential nerve centers in the medulla are at length affected and death ensues, but if vitamin B is given in time the lipoid of the adrenal cortex is liberated, the nuclear starvation of the central nervous system disappears, and the paralytic bird is restored to health with dramatic rapidity.

"If the hypothesis which we have suggested be correct, several facts can be viewed in a new light. It becomes apparent why muscular activity, by using up nuclear material in the central nervous system, as evidenced by chromatolysis, causes a shortening of the incubation period of beriberi; why, in fact, any condition such as growth, entailing an increased demand for nuclear material, should rapidly use up the available supply of vitamin B factor, while starvation, in which nuclear activity is reduced to a minimum, is not accompanied by symptoms of beriberi."

Concerning toxic by-products of Bacillus botulinus, J. BRONFENBRENNER, M. J. SCHLESINGER, and P. F. ORR (*Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 6, pp. 181, 182*).—In connection with studies of the botulinus toxin, it has been found that when *B. botulinus* is grown on a suitable medium other toxins are produced in addition to the specific toxin. On filtering such a culture through a Berkfeld candle and treating the filtrate with alcohol the secondary toxic products remain in solution. Intraperitoneal injection into 17 to 22 gm. mice of the alcoholic extract equivalent to 0.5 cc. of the original filtrate is fatal, the animal dying in from 5 to 15 minutes with convulsive seizures.

Similar products have been obtained from cultures of atoxic strains of *B. botulinus*, and also from those of *B. sporogenes*, *B. tetani*, and *B. proteus* when grown on minced meat broth. These toxins are considered to be chemical by-products of the bacterial metabolism rather than ordinary bacterial toxins, since they are dialyzable, act only in large amounts, and act immediately upon injection. These toxins are thermostable, not being destroyed even in the autoclave when heated in a sealed tube. In an open container, particularly in the presence of strong alkali, their toxicity diminishes with volatilization of basic products.

[Botulism] (*Calif. State Bd. Health Mo. Bul., 16 (1920), No. 3, pp. 33–52, figs. 7*).—This special botulism number contains the following papers, the subject matter for which has in general been noted from other sources: The Prevention of Botulism from Canned Foods, by E. C. Dickson; The Distribution of the Spores of *B. botulinus* in Nature, by K. F. Meyer; Scientific Methods of Processing and Packing the California Ripe Olive, by F. Simonds; Olive Pickling and Sterilizing Experiments, by W. V. Cruess; The Ripe Olive Industry, by C. H. Bentley; and Nutritional Worth of Ripe Olives, by M. E. Jaffa.

ANIMAL PRODUCTION.

Contribution to the physiology of development.—The process of growth during the hypofunction of one or more endocrine glands produced experimentally in young cats and dogs, A. PUGLIESE (*Biochem. e Terapia Sper., 6 (1919), No. 3, pp. 61–84, figs. 5; also in Arch. Ital. Biol., 70 (1920), No. 1, pp. 1–34, figs. 5*).—In young cats and dogs the author finds that unilateral thyroparathyroidectomy tends to increase body weight, while the removal of one adrenal capsule retards growth. The simultaneous ablation of one thyroid and one adrenal body usually was fatal to cats younger than four months. The kittens rapidly lost weight, and at the time of death (80 to 104 days later) the body weight was about 20 per cent of the initial weight. The body fat was greatly reduced, and the bones became small and thin and contained rela-

tively little nitrogen and fat. The remaining thyroid and adrenal body were found to be hypertrophied. Young dogs similarly operated on usually survived, but grew slowly and contained little fat. Their bones, although small and thin, were not changed much in composition. In most cases the remaining glands were not hypertrophied, but where the thyroid was enlarged the thymus became noticeably reduced, and the hypophysis (pituitary body) was usually reduced greatly in weight.

In adult animals the removal of a thyroid and an adrenal seemed to be without effect upon body development and function. In none of the experiments did the removal of the spleen have any influence on the results.

The parathyroid glands, W. M. Boothby (*Endocrinology, 5 (1921), No. 4, pp. 403–440*).—This is a critical review of the literature, with an extensive bibliography arranged in chronological order.

From the evidence at hand, the author concludes that the parathyroids are distinct in function from the thyroid, and are not embryonic thyroid tissue. There is also indication that the parathyroids are concerned in some way with calcium and guanidin metabolism and that they play a part in the regulation or maintenance of the acid-base equilibrium of the body. The presence of a very small amount of parathyroid tissue prevents or at least reduces the tetany which normally follows the removal of the parathyroid glands.

A contribution to the study of the epiphysis cerebri with an interpretation of the morphological, physiological, and clinical evidence.—I, The morphology and evolutional significance of the pineal body, F. Tilney and L. F. Warren (*Amer. Anat. Mem. [Wistar Inst.], No. 9 (1919), pp. 257, figs. 97*).—This is an elaborate survey of the published work on the structure of the pineal body, accompanied by a bibliography of 440 titles.

From a study of the gross and minute anatomy of the region in all classes of vertebrates and consideration of the embryological history, it is concluded that the pineal body is in no sense a vestige of an organ important only in the early evolutionary stages of the vertebrates. Under this view the connection between the pineal organ and the development of the parietal eye in the lower vertebrates was merely an adaptation to meet a temporary need. All the organs in the pineal region are considered essentially glandular in function. While in some instances the pineal body may contribute its secretion to the cerebro-spinal fluid, in the higher vertebrates it belongs to the endocrine system and discharges its secretion into the blood stream. The physiological and pathological aspects of the organ are to be considered in subsequent publications.

Contribution to the knowledge of the corpus pineale in the Mammalia, K. H. Krabbe (*K. Danske Vidensk. Selsk., Biol. Meddel., 2 (1920), No. 2, pp. 111, pls. 7, figs. 58*).—The author has studied the embryology, anatomy, and histology of the pineal body in a large number of mammals ranging from monotremes to primates.

Although the organ varies greatly in different species, there are certain features common to most mammals, particularly the conspicuous pineal cells, the general lack of connective tissue, and the occurrence of nerve cells of unusual types. The nucleus in a pineal cell is poor in chromatin and contains one or two nucleoli. The extensive vascularization of the organ, the occurrence of amitosis, and the extrusion of granules from the nucleus of the pineal cells are held to indicate that its activities are essentially glandular. One function suggested is the evacuation of the products of the metabolism of the brain. The organ in mammals is not considered a rudimentary pineal eye.

There is an 8-page summary in French and a bibliography of about 60 titles.

A review of the chromosome numbers in the Metazoa, II, E. B. Harvey (*Jour. Morph., 34 (1920), No. 1, pp. 1–67*).—This is a check list of the published

chromosome numbers of vertebrates and the various groups of invertebrates, and supplements the author's earlier review[1] of the chromosome numbers in annelids, arthropods, and coelenterates. A short review of the occurrence of sex chromosomes and other types of heterochromosomes is included.

From a survey of the counts the author concludes that the chromosome number is remarkably constant for a given species. Type numbers seem also to be characteristic of a related group, and it is held that most of the changes in numbers in related forms have resulted from the splitting or fusion of chromosomes.

Contributions to the knowledge of mammalian gametogenesis.—I, The spermatogenesis of Mus silvaticus, H. FEDERLEY (*Acta Soc. Sci. Fennicae, 48 (1919), No. 6, pp. 37, pl. 1, fig. 1*).—In this study of the spermatogenesis of a field mouse in Finland, the author could not determine exactly the number of chromosomes in the Spermatogonia, but the reduced number was approximately 21. An intranuclear body noticeable from the leptotene stage to the prophase of the first maturation division is thought to be a heterochromosome.

Rejuvenation by experimental invigoration of the senile gonads, E. STEINACH (*Arch. Entwickl. Mech. Organ., 46 (1920), No. 4, pp. 553–618, pls. 21, figs. 7*).—To increase the interstitial tissue in the gonads, the author operated on a number of rats in the last stages of senile decay. The usual operation in the case of males was the ligature and resection of either the ductus differentia or the ducts connecting the testes and the epididymides. Pieces of testes from young individuals were also implanted in some of the old males not otherwise operated on, and pieces of ovary from young rats were also implanted in old female rats. The operations had a marked effect, as the animals acquired a full coat of hair and assumed the sexual instincts and characters of much younger individuals.

Degenerative changes in the seminal epithelium and associated hyperplasia of the interstitial tissue in the mammalian testis, A. KUNTZ (*Endocrinology, 5 (1921), No. 2, pp. 190–204, figs. 5*).—In this paper the author continues his experimental studies of degenerative changes in the testis (E. S. R. 43, p. 269).

In rabbits and dogs testicular degeneration followed unilateral resection of the ductus deferens in all cases in which the lumen of the ductus became occluded, and in three of the four dogs subjected to this operation similar changes occurred also in the testis on the opposite side. In one case where the dog was allowed to live 142 days after the operation, the seminal epithelium on the side operated on was restored without reestablishment of the lumen. In two of the four dogs castrated on one side, degenerative changes appeared in the remaining testis.

Hyperplasia of the interstitial secretory tissue was a constant accompaniment of the advanced degenerative changes in the seminal epithelium. The term hyperplasia is preferred to hypertrophy, used in the earlier paper, because the enlargement involves an increase in the number of cellular elements. The hyperplasia is not considered a compensatory process.

Attempt at a methodical determination of the degree of inbreeding by means of mathematical methods, J. KŘÍŽENECKÝ (*Naturw. Wchnschr., 32 (1917), No. 6, pp. 73–78*).—This material has been noted from another source (E. S. R., 42, p. 63). The symbol Z_n is used in place of I_n in the inbreeding formula.

[1] Jour. Morph., 28 (1916), No. 1, pp. 1–63.

The mathematical treatment of the degree of inbreeding, F. BRETSCHNEIDER (*Naturw. Wchnschr., 32 (1917), No. 17, pp. 225–229*).—The author criticizes Kříženecký's method of measuring inbreeding because in some types of pedigree the coefficient may increase in value as additional generations are employed in the computations although no additional inbreeding is revealed by the extra generations.

In the mathematical treatment of inbreeding the author uses a method in which the degree of inbreeding exhibited by a pedigree is taken as the weighted sum of the inbreeding in the separate generations. The weights diminish in value with increase in the number of generations separating the propositus from the generation in which a particular case of inbreeding becomes effective, because in the author's view a given repetition of ancestors is of less importance as a contribution to inbreeding in remote than in recent generations. The fraction $\frac{1}{2^n}$ is selected for convenience as the weight or "diminishing factor" for the nth ancestral generation.

In working with a pedigree the author deals mainly with units of two ancestral generations, since inbreeding can not be disclosed by a less number except in cases of self-fertilization. If there are actually only three different grandparents, the inbreeding for two generations is $\frac{1}{2^2}\times\frac{1}{4}$ or 6.25 per cent (where $\frac{1}{2^2}$ is the diminishing factor), and if there are only two grandparents the inbreeding is $\frac{1}{2^2}\times\frac{1}{2}$, or 12.5 per cent. Any additional inbreeding involving collaterals only, discoverable from a knowledge of the grandparents of the parents, the grandparents of the grandparents, etc., is determined for each case separately. The extra determinations are averaged for a particular generation, multiplied by the appropriate diminishing factor, and added to the similarly treated determinations for the other generations. The sum is the total inbreeding revealed by the known pedigree. Continued brother and sister mating adds 12.5 per cent to the total for each ancestral generation considered beyond the first. For a pedigree of 10 or more generations the sum exceeds 100, but this defect is thought unimportant in practical work with pedigrees of domestic animals.

The type of inbreeding resulting from the mating together of relatives belonging to different generations is not treated in detail. The mating of parent and offspring is considered intermediate between self-fertilization $\left(\frac{1}{2}\times\frac{1}{2}\right)$ and the mating of a half-brother and a half-sister $\left(\frac{1}{2^2}\times\frac{1}{4}\right)$. The coefficient comes out 15.625 per cent.

Inbreeding and the biochemical specificity of the individual, L. LÖHNER (*Riv. Biol., 3 (1921), No. 2, pp. 129–149, figs. 2*).—The author claims that inbreeding is followed in all animals and plants by the same set of pathological conditions, which constitute a characteristic syndrome not produced in any other way. The idea that these conditions can be explained by the combination of hereditary factors is rejected, and the theory is proposed that the harmful results of inbreeding flow from the too great biochemical similarity of the parents. It is held that the offspring of related parents have chemical characters not conducive to the thorough functioning of the enzyms and hormones concerned in growth and development.

Survey of the shifting judgment in live-stock circles concerning the mating of relatives, C. OHLY (*Jahrb. Wiss. u. Prakt. Tierzucht, 13 (1919), pp. 13–63*).—The author traces the history of the idea of inbreeding and its implications from the time of Albrecht Thaer (end of the eighteenth century) to the work of Pearl and Křiženecký, and shows how recent developments in genetics provide an adequate explanation of the phenomena associated with inbreeding.

From scrubs to quality stock, D. S. BURCH (*U. S. Dept. Agr. Yearbook 1920, pp. 331–338, figs. 13*).—This is a report of progress of the "better sires—better stock" campaign of the Bureau of Animal Industry (E. S. R., 43, p. 464). The author includes a revision of previously noted data (E. S. R., 43, p. 770) as to the ratio of male to female breeding stock in the different classes of farm animals. The new ratios are: Cattle 1:17.5, horses 1:17.2, swine 1:11.1, sheep 1:32.2, goats 1:23.9, chickens 1:23.9, and other domestic birds 1:10.6.

Runts and the remedy, J. R. MOHLER (*U. S. Dept. Agr. Yearbook 1920, pp. 225–240, figs. 7*).—This paper is based upon a collection of breeders' opinions as to the reasons for the occurrence of undersized animals and the measures likely to reduce the number of such occurrences. Poor feeding methods and inferior breeding stock are the principal assigned causes for runts, but parasites, disease, inadequate housing, exposure, and in the case of pigs the crowding incident to large litters are also considered important factors. Many of the runts in poultry are attributed to inbreeding. Most hog breeders seem to consider the raising of runts unprofitable, but some report successful growth by the use of special care in feeding.

On the assimilation of lime and phosphoric acid in the animal organism, F. HONCAMP and E. DRÄGER (*Landw. Vers. Sta., 93 (1919), No. 3–4, pp. 121–134*).—Experiments are reported with 12 rabbits, 3 pigs, and 2 lambs fed basal rations poor in ash to which were added bone meal and other preparations containing calcium and phosphorus. The utilization of the mineral matter furnished was estimated from the chemical composition of the bones in the case of the rabbits, and by the differences between intake and outgo in the case of the pigs and lambs.

The assimilation of the minerals supplied was found to depend greatly on the individuality of the animals, but they all seemed able to satisfy their calcium and phosphorus needs from inorganic sources. The addition of inorganic preparations did not change the digestibility of the organic nutrients in the basal ration of oat straw, wheat grits, potato flakes, and wheat gluten fed to lambs. There was some indication that an increase in lime intake increased the proportion of phosphorus assimilated.

On the use of woody materials in live-stock feeding.—I, Researches conducted on corncobs, F. SCURTI and G. MORBELLI (*Staz. Sper. Agr. Ital., 52 (1919), No. 5–6, pp. 238–265*).—This is a study of the influence of hydrolysis on the composition of corncob meal. The untreated meal contained on a dry basis 38.6 per cent crude fiber and 57 per cent nitrogen-free extract. The pentosan content was 15.8 per cent.

After digestion in dilute sulphuric acid for two hours at 130° C. under pressure of less than two atmospheres, from 33 to 47.5 per cent of the material was converted into reducing sugar, the maximum sugar production occurring when 1 part of the material was treated with 10 parts of 0.4 per cent acid. The yield of sugar was lower with a smaller proportion of water, with shorter or longer periods of hydrolysis, and when the pressure was increased to 5 or 10

atmospheres. Hydrolysis with hydrochloric acid resulted in a maximum sugar production of 40.5 per cent, while treatment of 1 part of the material with 5 parts of 0.225 per cent nitric acid converted 44 per cent of the material into reducing sugars. Treatment with sodium hydroxid produced only traces of sugar. Glucose, arabinose, and xylose were identified among the soluble carbohydrates.

On the use of woody materials in live-stock feeding.—II, Researches conducted on wheat straw, F. SCURTI and G. DROGOUL (*Staz. Sper. Agr. Ital., 52 (1919), No. 10–12, pp. 490–496*).—As in the corncob investigations noted above, the authors found that the crude fiber decomposed into cellulose and reducing sugars when hydrolyzed with acids under pressure. The untreated straw contained 33.76 per cent crude fiber and 55.17 per cent nitrogen-free extract, the pentosan content being 27.3 per cent. With a 10 per cent solution of sulphuric acid for two hours at 130° C., hydrolysis produced the maximum proportion of reducing sugars, 32.59 per cent. There was a maximum production of 33 per cent sugar with hydrochloric acid (2.5 per cent solution) and 34.8 per cent sugar with nitric acid (7.5 per cent). Treatment with sodium hydroxid resulted in only traces of reducing sugars.

On the chemical composition and feeding value in different growth stages of the foliage and the twigs of a number of species of trees, O. ENGELS (*Landw. Vers. Sta., 97 (1921), No. 5–6, pp. 293–356*).—The author reports extensive determinations of the chemical composition of the leaves, twigs, and branches of black alder, hazel, oak, beech, locust, linden, horse-chestnut, black poplar, willow, birch, ash, and sycamore trees. Collections were made in May, July, and October. The use of these materials as feeding stuffs is reviewed, and the digestible nutrients, particularly the protein, are estimated from published digestion trials.

Forage materials [in the Sudan], A. F. JOSEPH (*Wellcome Trop. Research Lab., Chem. Sect. Pub. 18 (1921), pp. 17–21*).—Proximate analyses including determinations of pentosans and soluble carbohydrates are reported of samples of stalks, leaves, and straw of durra and maize, dukn straw (*Pennisetum typhoidium*), cotton leaves, lubia (*Dolichos lablab*), heads and stalks of naal grass (*Cymbopogon nervatus*), naal hay, and oom soof (*Panicum pyramidole*).

Beechnut oil meal and fruit pit oil meal, F. HONCAMP (*Landw. Vers. Sta., 93 (1919), No. 3–4, pp. 97–106*).—The ground dried residues of beechnuts and of fruit pits after oil extraction were each fed to two sheep during a 9-day digestion trial. The roughage was meadow hay which was also fed alone during a preliminary period, results of which are tabulated. The beechnut oil meal contained 87 per cent dry matter and on the dry basis had the following percentage composition: Crude protein 19.5, ether extract 4.9, crude fiber 26.9, and nitrogen-free extract 40.5. The average digestion coefficients were: Organic matter 40, crude protein 69.8, crude fat 96.2, crude fiber 21.3, and nitrogen-free extract 31.3. The fruit oil meal contained on the dry basis crude protein 26.1, ether extract 2.1, crude fiber 27.6, and nitrogen-free extract 30.7 per cent. The average digestion coefficients were: Organic matter 57.2, crude protein 83, ether extract 89.3, crude fiber 14.1, and nitrogen-free extract 73.2.

Analyses of commercial feeding stuffs and registrations for 1921, C. S. CATHCART (*New Jersey Stas. Bul. 354 (1921), pp. 5–68*).—This is a report on 876 samples of feeding stuffs collected under the State law in 1920. Data as to the moisture, protein, fat, and fiber content of the following products are given: Alfalfa meal, brewers' dried grains, distillers' dried grains (corn, malt), malt sprouts, buckwheat feed, buckwheat middlings, buckwheat offal, coconut oil meal, cottonseed feed, cottonseed meal, corn gluten feed, corn gluten meal,

corn-and-cob meal, hominy feed, dried beet pulp, linseed meal, peanut oil meal, rice bran, rye middlings, rye bran, wheat bran, wheat middlings, red dog, wheat mixed feed, middlings and palm oil, and various proprietary mixed feeds, calf meals, and poultry feeds. The moisture, protein, fat, and phosphoric acid in samples of meat scrap, fish scrap, tankage, and bone meal are also reported.

The prices of 30 of these products in 1921 and comparative prices of 17 in the five preceding years are tabulated.

The composition of some feeding stuffs, B. DE C. MARCHAND and B. J. SMIT (*Union So. Africa, Dept. Agr. Bul. 5 (1919), pp. 11*).—The authors report the proximate composition of 34 samples of feeding stuffs derived from plants grown in South Africa, including corn, corn stover, mealie meal, cottonseed meal, soy bean cake, brewers' dried grains, teff hay, alfalfa hay, beans and pods of *Acacia giraffae*, beans of *A. horrida*, *Mesembrianthemum floribundum*, and grasses belonging to the genera Bouteloua, Digitaria, Eragrostis, Ehrharta, Heteropogon, Ischaemum, Panicum, Pennisetum, Setaria, and Trichloris.

Feeding blackstrap molasses to young calves, R. C. CALLOWAY (*Louisiana Stas. Bul. 180 (1921), pp. 3–22, fig. 1*).—Fourteen newborn calves were fed for upwards of 24 weeks on skim milk, a grain mixture (wheat bran, corn meal, velvet bean meal, and oats, 2:1:1:1), hay, and corn and soy bean silage. To the grain ration of half the calves was added blackstrap molasses, in small amounts at the beginning and at the rate of 2 lbs. per day for the older calves at the end. The molasses had no laxative effect and did not produce scours when fed cautiously. It acted as an appetizer, increased the gains somewhat, and caused a reduction in the cost of raising calves to the age of six months at least.

Judging sheep, G. H. BEDELL (*U. S. Dept. Agr., Farmers' Bul. 1199 (1921), pp. 23, figs. 27*).—Directions are given, accompanied by detailed illustrations, for judging sheep by means of the score card.

Practical synopsis of canine races, H. ZWAENEPOEL (*Ann. Méd. Vét., 66 (1921), No. 6, pp. 264–269*).—The author presents an artificial key to the breeds and varieties of dogs and also classifies the types of coat color.

The rate of growth of the domestic fowl, S. BRODY (*Jour. Gen. Physiol., 3 (1921), No. 6, pp. 765–770, figs. 4*).—From the shapes of the curves plotted from data on the growth of chickens published by various investigators, the author concludes that the growth cycles are capable of being graduated by the equation for an autocatalytic monomolecular reaction employed in his earlier studies on ovulation in the domestic fowl and growth in dairy heifers (E. S. R., 45, pp. 70, 378). Only one equation is reported, however, that for the growth of Rhode Island Red chicks from hatching to the age of 14 weeks, as tabulated by Card and Kirkpatrick (E. S. R., 40, p. 670). This equation is

$$\text{Log}\frac{x}{2.76-x}=0.182\,(t-8.5)$$

where x is weight in pounds and t is age in weeks. The first postembryonic cycle is followed by a second terminating somewhere between 24 and 28 weeks, depending to some extent upon the breed. From the weights of embryos reported by K. A. Hasselbalch[2] and by Lamson and Edmond (E. S. R., 31, p. 172) indications are found of at least one and perhaps two definite growth cycles before hatching.

Comparison of the power of the organs of flight in breeds of poultry, J. CHAINE (*Actes Soc. Linn. Bordeaux, 71 (1919), Proc. Verb., pp. 27–30*).—The author makes comparisons between Cochin China fowls, which he has never

[2] Skand. Arch. Physiol., 10 (1900), No. 6, pp. 353–402.

known to attempt flight, and Minorcas which are considered very good fliers. Definite measurements showed that the wings were much shorter in the Cochin Chinas relative to the body length, the pectoral muscles weighed relatively less, and the surface of the tail was much smaller in proportion to the body surface.

Selecting laying hens, R. B. THOMPSON (*Arizona Sta. Circ. 39 (1921), pp. 8, figs. 2*).—An outline is given of the physical characteristics of hens which are supposed to indicate egg production.

How can pullets be brought into laying? MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 55–57*).—Suggestions are given for changes in the feeding schedule during the fall to induce pullets to lay.

Maintaining a standard egg pack, G. R. SHOUP (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 53–55*).—The author suggests the keeping of a few actively laying yearlings for a short time in the fall, so that their eggs, mixed with the eggs of the pullets, will bring up the average weight to that required for a standard egg pack, 45 lbs. per case of 30 doz.

DAIRY FARMING—DAIRYING.

Influence of condition on maintenance requirements of dairy cattle, A. C. MCCANDLISH and W. G. GAESSLER (*Iowa Sta. Research Bul. 60 (1920), pp. 403–420, figs. 6*).—Two cows, No. 91, a 10-year-old Ayrshire, and No. 262, a senior 3-year-old Guernsey × Ayrshire, were fed until they were moderately fat and then kept on a maintenance ration for 150 days during the winter of 1917–18 (period 1). In the following summer they were fed on pasture and on oat hay until they became lean, and during the next winter were again kept on a maintenance ration for 150 days (period 2). During each maintenance period a 10-day digestion trial was conducted with each animal and from these data the maintenance requirements were computed with the results tabulated below. The grain ration fed consisted of hominy feed and wheat bran (3:2).

Influence of condition (body weight) of cows on digestibility of ration and maintenance requirements.

Herd number of cow.	Period.	Average weight during maintenance.	Feed consumed during 10-day digestion trial.			Digestibility of feed.				Daily maintenance requirements per 1,000 pounds live weight.			
			Grain.	Clover hay.	Corn silage.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Digestible protein.	Digestible fat.	Digestible carbohydrate.	"Total" nutrients.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
91	1	1,101	10.0	35	200	58.9	80.2	55.5	74.4	0.59	0.25	5.77	6.92
	2	869	2.5	40	150	52.9	78.7	48.8	71.4	.42	.20	4.62	5.49
262	1	1,074	10.0	40	200	61.3	80.8	62.2	77.8	.65	.26	6.47	7.71
	2	898	2.5	40	150	46.3	79.6	49.1	71.4	.36	.20	4.52	5.33
Average of both	1	1,087	10.0	38	200	60.2	80.5	58.9	76.1	.62	.25	6.11	7.39
	2	884	2.5	40	150	49.6	79.2	48.9	71.4	.39	.20	4.58	5.42

The estimated coefficients of digestibility computed from the averages of Henry and Morrison are lower than those actually found during the high condition, and in general are higher than those observed during period 2. During maintenance at a low body weight the animals consumed abnormal quantities of salt, but the water requirements seemed to vary but little with the condition.

Analyses of corn silage and clover hay fed in the experiments are included.

The preparation of corn for dairy cows, A. C. McCandlish and G. E. Weaver (*Iowa Sta. Bul. 195 (1921), pp. 299–304*).—To compare ear corn and corn-and-cob meal with corn meal for milch cows, a feeding experiment was conducted with five cows during five 20-day periods, each separated by a 10-day transition period. The basal ration consisted of corn silage, clover hay, and a mixture of wheat bran, linseed meal, cottonseed meal, and ground oats (4:4:2:1). Corn meal was given in addition during periods 1, 3, and 5, ear corn was added during period 2, and corn-and-cob meal during period 4, the amounts of the corn preparations being adjusted so that the proportion of dry matter from corn grain would be the same in each period. The cows were fed as one lot.

From a comparison of the production records in the successive periods, it is concluded that 1 lb. of corn meal is equivalent for butter-fat production to 1.25 lbs. of corn-and-cob meal or 1.4 lbs. of ear corn. It is pointed out that with bran and oats in the grain mixture the added bulk supplied by the cob of the corn-and-cob meal is of no particular value, whereas in the comparisons between corn meal and corn-and-cob meal reported by Cook from the New Jersey Stations (E. S. R., 30, p. 375) the bulk of the corn-and-cob meal served a useful purpose since the only other concentrate fed was cottonseed meal.

Performance in some of the leading Guernsey sires, D. Meade (*Jour. Dairy Sci., 4 (1921), No. 2, pp. 95–104*).—The author has studied the production records of the daughters of all the Guernsey bulls—13 in number—having at least 25 advanced registry daughters of record July 1, 1918, and also the daughters of a younger bull notable for the records of his daughters. The butter-fat production of each daughter is expressed as a percentage of the advanced registry requirements for her age class, and the average for each bull determined. These averages range from 128 to 211 per cent. It is pointed out that it is easier for cows in certain age classes to meet the advanced registry requirements than it is in others.

Cows that make the income climb, J. C. McDowell (*U. S. Dept. Agr. Yearbook 1920, pp. 401–412, figs. 8*).—This is a statement of the advantages accruing to dairymen by belonging to cow-testing associations.

Management of the fall-freshening cow, H. E. McNatt (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 62–64*).—The advantages of winter dairying are pointed out, and suggestions are given for the feeding and care of cows freshening in the fall.

The production of clean milk, R. N. Davis (*Arizona Sta. Circ. 37 (1921), pp. 12, figs. 12*).—Suggestions are given for the care of cows, barns, milk houses, and dairy utensils to prevent contamination of milk.

Milk for midshipmen, E. Kelly (*U. S. Dept. Agr. Yearbook 1920, pp. 463–470, figs. 6*).—This is an account of the management of the dairy herd attached to the U. S. Naval Academy at Annapolis. Reduction in gastrointestinal disorders among the midshipmen since the establishment of the herd is attributed to the up-to-date methods of handling the milk.

Factors influencing the cost of production of milk, A. G. Ruston and W. R. Crawford (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 119 (1921), pp. 46, figs. 3*).—This is an analysis of the cost of milk production based on a study of the balance sheets of 25 dairy farms in Yorkshire in the years 1913–14 to 1919–20. The factors involved are divided into three groups: (1) Those not under the control of the producer, such as the influence of the war on labor costs, costs of feed, and the price of cattle; (2) those only slightly under control, such as seasonal variations; and (3) those largely under control, such as the influence of herd management on milk yields, utilization of labor, and the use of pastures and home-grown feeds.

The cost of producing milk, H. B. MUNGER (*Iowa Sta. Bul. 197 (1921), pp. 339–352*).—This is a report of a survey during the year ended October 31, 1917, of 58 farms in Cerro Gordo County, Iowa, supplying fluid milk or cream to the Mason City market. The records are computed on the "cow" basis, and no charge for managerial ability is included. The average production was 4,565 lbs. The pasture season usually began May 10, lasted about 140 days, and was followed by an average period of 48 days in which the cows received grain and roughage in addition to some pasture. The winter season averaged 177 days.

The units required for the production of 100 lbs. of milk were as follows: Corn, 26.5 lbs.; other concentrates, 12.6 lbs.; legume hay, 20.2 lbs.; other hay, 47.2 lbs.; corn stover, 19 lbs.; straw, 9.6 lbs.; silage, 116.2 lbs.; other succulence, 0.9 lb.; pasture costs, 40.6 cts. (excluding a small charge for pasturing cornstalks); bedding 7 cts.; human labor 3.2 hours; and horse labor, 1.2 hours. The percentage contribution of each item to the gross costs was as follows: Feed, 59.2; bedding, 1.9; human labor, 18.4; horse labor, 3.5; equipment, 2; buildings, 5.4; depreciation, interest, and taxes on cows, 4.8; cost of bull, 2.7; and miscellaneous costs, 2.1. With a credit of 16 cts. for calves and 20 cts. for manure, the average net cost of producing 100 lbs. of milk was $3.15. There was considerable variation from farm to farm in the actual net cost.

Investigation of the production, distribution, and prices of milk, J. H. HAY (*Minn. Dept. Agr. Bul. 2 (1920), pp. 14*).—Statistics are presented of the production of milk, butter fat, and manufactured dairy products in the State, estimates of the cost of producing market milk, and data on the cost of distributing milk in Minneapolis, St. Paul, Duluth, and other cities.

Seventh annual report of the creamery license division for the year ending March 31, 1921, T. H. BROUGHTON (*Indiana Sta. Circ. 103 (1921), pp. 3–16, figs. 2*).—This consists of lists of plants licensed in Indiana to manufacture dairy products, together with information concerning examinations for testers' licenses and the inspection of glassware. The statistical data of previous reports (E. S. R., 43, p. 682) are revised to include the year 1920.

Creamery bookkeeping, M. MORTENSEN (*Iowa Sta. Circ. 68 (1921), pp. 20, figs. 12*).—Descriptions and illustrations of 16 forms, useful in keeping the records of a creamery's business, are presented. These include financial statements and inventories, as well as drivers' reports, route checking records, purchase records, sales tickets, and the like.

Neutralization of overripe milk for cheese making, J. G. MCMILLAN (*N. S. Wales Dept. Agr., Farmers' Bul. 136 (1921), pp. 20; abridged in Agr. Gaz. N. S. Wales, 32 (1921), No. 1, pp. 35–41*).—The author presents reports of various experiments in manufacturing cheese from neutralized sour milk. The treatments discussed are designed for emergencies and are not such as would be used under normal conditions.

The neutralization of high acid milk to a normal degree of acidity by means of sodium hydroxid, using lime water in the whey, was found to produce a good marketable cheese in the wintertime. Free lime was found to decompose the protein with the production of ammonia. In the summer time neutralization with sodium hydroxid, followed by pasteurization and treatment with calcium chlorid to restore the coagulating properties lost by heating, did not in general produce a satisfactory cheese. When, however, only the evening milk was thus treated and was mixed with the raw morning milk, better results were secured. When the milk was only moderately acid, rapid manufacturing methods involving relatively high temperature and extra rennet proved more satisfactory than any of the neutralization methods tested.

The neutralization of cream.—Mixed lime and bicarbonate of soda as an agent, L. T. MacInnes (*Agr. Gaz. N. S. Wales, 32 (1921), No. 2, pp. 113, 114; also in N. Y. Produce Rev. and Amer. Creamery, 51 (1921), No. 22, p. 1168*).—The author reports success in manufacturing butter from high acid cream neutralized with equal parts of lime and sodium bicarbonate and then pasteurized. Both the holding and the flash methods of pasteurization were employed. With the former the viscosity was found to be less than when lime alone is used, and with the latter there was less froth than when soda was used alone.

Fruity flavors in milk and cheese, R. Snell (*Queensland Agr. Jour., 16 (1921), No. 1, pp. 19, 20*).—The author finds that the occurrence of odors in milk resembling those of ripe fruit is due in great part to contamination with *Bacillus coli communis*. Cleaning the udder and rejecting the fore milk are suggested as preventive measures. In cheese making the flavor can be counteracted by the use of a high acid lactic starter or by other methods whereby a relatively high acidity is developed before the whey is drawn.

A new modification and application of the Gram stain, G. J. Hucker (*Jour. Bact., 6 (1921), No. 4, pp. 395–397*).—In using the Gram staining methods on milk smears prepared for microscopic examination, the author, working at the New York State Experiment Station, found that the addition of 5 parts of a mixture of anilin oil and xylol (2:1) to 95 parts of the destaining alcohol aids in the control of the decolorizing process, so that the Gram-positive organisms do not lose their stain in the time required for the milk and the Gram-negative types to become colorless. Bismarck brown was the most satisfactory of several counter stains tested. Parallel counts with smears stained with methylene blue by the usual Breed procedure gave substantially the same total counts as the new method. The method makes it possible to discriminate between gas formers and lactic acid types, and has been used successfully in routine examinations at a cheese factory to eliminate milk likely to develop gassy curds.

The cause of eyes and characteristic flavor in Emmental or Swiss cheese, J. M. Sherman (*Jour. Bact., 6 (1921), No. 4, pp. 379–391, pl. 1*).—In this contribution from the Dairy Division, U. S. Department of Agriculture, the cultural and morphological features are described of a propionic acid bacterium isolated from American-made Swiss cheese. It differs somewhat from *Bacterium acidi propionici* (*a*) of Von Freudenreich and Jensen (E. S. R., 18, p. 177) and is tentatively designated *B. acidi propionici* (*d*). Factory experiments showed that this organism is capable of producing the holes and the characteristic sweetish taste of cheese of the Emmental type. It is also responsible for much of the catalase production previously studied by the author (E. S. R., 44, p. 274).

Lactate-fermenting bacteria in numbers exceeding a million per gram were found to be present in market samples of domestic Swiss cheese. The failure of previous workers to secure such large counts is attributed to the use of culture media of too high an H-ion concentration. The author uses sodium lactate in place of the customary calcium lactate in the peptone-lactate broth, thus avoiding the precipitation of calcium phosphate during sterilization.

Two discussions of the practical aspects of the results secured in these investigations have been noted (E. S. R., 44, p. 874).

Associative bacterial action in the propionic acid fermentation, J. M. Sherman and R. H. Shaw (*Jour. Gen. Physiol., 3 (1921), No. 5, pp. 657, 658*).—As a by-product of the investigation noted above, the authors report observations showing that the propionic acid production of *Bacterium acidi propionici* (*d*) in a lactose medium is greatly increased by the presence in the culture of

another organism, such as *Streptococcus lacticus* or *Lactobacillus casei*, known not to produce this fermentation.

Comparative study of methods of testing cheese for fat, O. BORELLO (*Staz. Sper. Agr. Ital., 53 (1920), No. 12, pp. 471–493*).—The author reports parallel determinations of the fat in various types of cheese from which it is concluded that the Schmid-Bondzinski is nearly as accurate as the Roese-Gottlieb and the Gerber methods.

The Schmid-Bondzinski method is essentially the Schmid-Werner method modified for use with cheese instead of milk. The sample is boiled in hydrochloric acid and after cooling is shaken with ether. With the simplifications which the author suggests for the removal of the layer of fat and ether for test as to fat content, the method is considered speedy enough for commercial use.

Sandy crystals in ice cream: Their separation and identification, H. F. ZOLLER and O. E. WILLIAMS (*Jour. Agr. Research [U. S.], 21 (1921), No. 10, pp. 791–796, pls. 2; also in Creamery and Milk Plant Mo., 10 (1921), No. 10, pp. 72, 75, 76, figs. 5*).—The authors, working in the Dairy Division of the U. S. Department of Agriculture, prepared ice cream so that it developed sandiness. The crystals were removed from the melted ice cream by centrifugal action, and on microscopic examination were found to be lactose crystals and not crystals of cane sugar as has sometimes been claimed. Comparison of the solubilities of lactose and sucrose confirmed this conclusion. The crystals were of the normal α form.

VETERINARY MEDICINE.

Practical bacteriology, blood work, and animal parasitology, E. R. STITT (*Philadelphia: P. Blakiston's Son & Co., 1920, 6. ed., rev. and enl., pp. XI+633, pl. 1, figs. 177*).—This is a revised and enlarged edition of the work previously noted (E. S. R., 41, p. 184).

Toxins and antitoxins, M. NICOLLE, E. CÉSARI, and C. JOUAN (*Toxines et Antitoxines. Paris: Masson & Co., 1919, pp. VIII+123*).—The authors state in their preface that this book constitutes less a résumé of classical researches on the subject than an original statement of their own investigations extended over a long period of time. A list of the original papers upon which the work is based, many of which have been previously noted, is included.

Polyvalent antibody response to multiple antigens, F. M. HUNTOON and S. H. CRAIG (*Jour. Immunol., 6 (1921), No. 3, pp. 235–247, figs. 2*).—The authors discuss the factors which limit polyvalent antibody production from the basis of experimental data of their own and of other workers, including two papers by Castellani (E. S. R., 14, p. 393; 33, p. 477). The conclusion is drawn that "as yet no limit has been found as to the number of antigens which will elicit a simultaneous response. Such responses approach in volume that obtained with single antigens.

"Our experience with the multiple bacterial immunization of animals and with the coincident immunization of animals against toxins and bacterial antigens leads us to the conclusion that there is nothing in the immunity mechanism itself to preclude the possibility of a very wide polyvalent antibody production. The undoubted fact that many animals under multiple antigen immunization at times fail to respond with as great a volume of production as occurs with single antigens may be explained by other factors, such as a depreciation of the general physical condition due to the large amounts of bacterial protein injected."

Potency of bacterial vaccines suspended in oil (lipovaccines), I. A. BENGTSON (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 122 (1920), pp. 33–42*).—This is a preliminary report of work which has been done in an effort to estab-

lish standard methods of determining the potency of lipovaccines. As yet sufficient data have not been obtained to justify the establishment of any definite standard or method of testing.

Standarization of gas gangrene antitoxin, I. A. BENGTSON (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 122 (1920), pp. 13–31, figs. 4*).—This paper consists of a discussion of the bacterial flora responsible for gas gangrene, and of methods adopted at the Hygienic Laboratory, U. S. Public Health Service, for the preparation and standardization of toxins and antitoxins for *Bacillus perfringens* (*B. welchii*), *Vibrion septique*, and *B. edematiens*. Data are also given on the deterioration of perfringens toxins under different conditions.

Some observations regarding eosinophiles, L. H. WRIGHT (*Jour. Agr. Research [U. S.], 21 (1921), No. 9, pp. 677–688*).—This is a contribution from the Nevada Experiment Station in which the author reports upon observations extending over a period of about 18 months, during which time from 1 to more than 20 examinations were made of the blood of each of 40 cases. The details of the blood counts are presented in tabular form for 15 horses in apparent good health, for which the average was 5.3 per cu. mm.; 8 horses in poor condition due to internal parasites, with an average of 2.2; 15 horses suffering from infectious equine anemia, of which 8 were of the acute form, with an average of 2.5; 2 horses with subacute infectious equine anemia, with an average of 1.2; and 7 horses with chronic infectious equine anemia, with an average of 2.9; and 2 miscellaneous blood counts.

The results show that the percentage of eosinophiles in the peripheral blood of healthy horses varies greatly even when the examinations are made at frequent intervals. It is thought that this fact may account for many of the different conclusions arrived at by many authors regarding the percentages of eosinophiles in the blood of normal horses or horses suffering from various diseases. It is pointed out that the resistance of the animal has apparently often been lost sight of. Thus, if the resistance of the animal is high the eosinophiles would be plentiful in parasitic diseases, and would be few if the resistance were low.

[Live stock diseases in Louisiana] (*La. State Live Stock Sanit. Bd. Bien. Rpt., 6 (1919–20), pp. 19–82, figs. 8*).—These pages are essentially a reprint of the corresponding sections in the last report (E. S. R., 40, p. 86), with the addition of a questionnaire on hog cholera similar to the one on anthrax.

Proceedings of the Wisconsin Veterinary Medical Association, sixth annual meeting held at Madison, Wis., January 18, 19, and 20, 1921, edited by F. B. HADLEY (*Wis. Vet. Med. Assoc. Proc., 6 (1921), pp. 131, figs. 4*).—Among the more important papers here presented are the following: Some Common Causes of Sterility and Methods of Recognition, by E. A. Schmoker (pp. 55–58); Interesting Experiences in Cattle Practice, by H. Lothe (pp. 59–62); Some Diseases of the Udder, by T. H. Ferguson (pp. 63–66); Detecting Sick Cows by the Milk, by F. B. Hadley (pp. 67–74); The Hog Cholera Situation in Wisconsin, by J. T. Purcell (pp. 75–77); Making it Safe for the Swine Industry, by T. P. White (pp. 78–86); Contagious Abortion of Sows, by B. A. Beach (pp. 87–89); Hog Cholera and Its Complications as Met by the Practitioner, by H. B. Piper (pp. 90–93); The Intradermal Method and Its Relation to Area Control, by J. P. West (pp. 101–104); Observations on Tuberculosis Control Work, by J. S. Healy (pp. 105–108); Interstate Inspection of Cattle, by O. H. Eliason (pp. 109–111); and Differential Diagnosis of Swine Diseases, by D. B. Clark (pp. 115–117).

The mio-mio or romerillo [Baccharis cordifolia], J. M. QUEVEDO (*Rev. Soc. Rural Córdoba [Argentina], 19 (1919), No. 356, pp. 4680–4686*).—This account

relates to *B. cordifolia*, which has a violent toxic action and is capable of causing the death of domestic animals (equines, bovines, and ovines) in a few hours. The paper deals with the toxicity of the plant, symptoms and lesions produced, diagnosis, treatment, and prophylaxis.

Toxicity experiments with mio-mio [Baccharis cordifolia], J. M. QUEVEDO (*Rev. Soc. Rural Córdoba [Argentina], 19 (1919), No. 357, pp. 4733–4744*).—This is a brief report of experiments conducted with *B. cordifolia*, known as romerillo or mio-mio, a general account of which is given in the paper noted above.

The poison parsnip or water hemlock (Cicuta occidentalis), a plant deadly to live stock in Nevada, C. E. FLEMING, N. F. PETERSON, ET AL. (*Nevada Sta. Bul. 100 (1921), pp. 23, pl. 1, figs. 8*).—This bulletin reports upon several series of feeding tests with *C. occidentalis* conducted from 1918 to 1920 at the Nevada Experiment Station. An account of this plant based upon investigations in Colorado by Clawson and Marsh has been previously noted (E. S. R., 30, p. 880).

This plant grows in wet, marshy soil or in shallow water, being common along streams and around ponds and in or among ditches. In Nevada it is most commonly found along irrigation ditches and scattered over wet meadows and pastures.

The feeding experiments reported have shown the plant to be highly toxic to cattle, sheep, and horses. The tops of the plant are deadly in the early spring, almost as much so as the tubers, but as they grow larger they cease to be poisonous. Two oz. or more of the old tubers is sufficient to kill ordinary range ewes or to make them sick, and 10 to 12 oz. will usually produce fatal results in fully matured cows, while a dose of from 8 oz. to 1 lb. of the old tubers will kill a horse.

"The young tubers are much less poisonous than the old ones. . . . Water hemlock tubers shipped to Reno from Nebraska were much less poisonous than the tubers found growing in Nevada. For sheep it takes from 16 to 75 minutes for symptoms to appear. In the cow it takes about an hour and in horses about 45 minutes. There is no known remedy. Drying does not immediately destroy the poisonous principle in the plant. One-half oz. of dried tubers killed a mature ewe.

"The poison parsnip is easily removed from fields by grubbing. Great care must be taken to dispose of all the tubers, so that live stock can not get any chance to eat them."

A brief discussion of the active poisonous principle of Cicuta, cicutoxin, noted by Jacobson (E. S. R., 34, p. 185), is appended.

Death camas (Zygadenus paniculatus and Z. venenosus), plants poisonous to sheep and cattle, C. E. FLEMING, N. F. PETERSON, ET AL. (*Nevada Sta. Bul. 101 (1921), pp. 31, figs. 13*).—This bulletin reports upon feeding experiments with sheep and cattle conducted with a view to determining the poisonous effect of the two kinds of death camas most common in Nevada, namely, the foothill death camas (*Z. paniculatus*) and the meadow death camas (*Z. venenosus*). The names applied to these two forms relate to their habits of growth, the former being found in the foothills among sagebrush and other range browse, while the latter is more plentiful in moist, grassy places. The foothill form is said to be the more common in Nevada, being found on most of the ranges in the northern part of the State. A report of earlier investigations at the station has been noted (E. S. R., 39, p. 184), as have also investigations by Marsh et al. (E. S. R., 33, p. 177), and by Heyl, Hepner, and Loy (E. S. R., 30, p. 412).

In feeding experiments it was found that from 0.25 to 0.5 lb. of the green leaves make a range sheep sick when the animal is confined in a pen, and that 3 lbs. or more are required to kill a sheep under the same conditions. It is thought that on the range where sheep are driven hard and have no chance to rest and recover smaller doses will often prove fatal. "On the whole, however, under ordinary range conditions it must be somewhat difficult for even one sheep in a band to obtain a fatal dose of the death camas leaves; and it is probable that many losses thought to have been caused by death camas were in reality caused by some other plant.

"Sheep fatally poisoned by death camas froth at the mouth and slobber freely, and occasionally vomit. They grow weak in the hind legs and stagger when made to walk. Within a few hours they become very dull and weak, standing with head and ears drooping and the back arched. Later, they go down and thereafter rise with difficulty if at all, becoming gradually weaker and usually dying within 24 hours from the time of feeding.

"Cattle show much the same set of symptoms but are apt not to froth at the mouth and drool as much as sheep. When in good condition they vomit so freely that they recover within two or three days."

None of the young cattle were killed in the feeding experiments. Doses of from 6 oz. to 2 lbs. made the animal sick but caused prompt and profuse vomiting which brought about a fairly rapid recovery. It is thought that on the range death probably occurs only when half-starved cattle eat a considerable quantity, where the system is too weak to throw off the poison, or where weak animals, driven hard, are poisoned and get no chance to rest and recover. There is no known remedy for death camas poisoning.

In section 2 of this bulletin (pp. 27–31) post-mortem conditions of six poisoned sheep are considered, followed by a discussion of the active principle of death camas, including a review of the literature relating to the subject.

Poisoning of cattle by feeding on Paspalum dilatatum infected with Claviceps paspali, D. T. Mitchell (*So. African Jour. Sci., 16 (1920), No. 5, pp. 391–396*).—It is pointed out that the causal agent of ergotism in Natal has been demonstrated to be *C. paspali*, associated with Paspalum lands which have been established for some years.

The "alkali disease" of live stock in the Pecos Valley, C. D. Marsh and G. C. Roe (*U. S. Dept. Agr., Dept. Circ. 180 (1921), pp. 8, figs. 4*).—This is a brief report of experiments with the disease known as milk sickness or alkali disease conducted at Roswell, N. Mex., supplemented by checking experiments at the experiment station near Salina, Utah. The disease has been known for many years in the Pecos Valley of New Mexico and Texas, where it has caused heavy losses of cattle and horses in the pastures.

The work has shown that the rayless goldenrod (*Isocoma wrightii*), long suspected as being poisonous to cattle, horses, and sheep, produces a definite line of symptoms corresponding to those considered characteristic of the affection. The experimental evidence obtained indicates that an average daily feeding of 1.5 lbs. of the green plant per 100 lbs. of animal, continued for a week, may produce toxic symptoms or death. Thus an average sheep may be poisoned or killed by a daily feeding of 1.15 lbs. continued for a week, or a 500-lb. steer may be poisoned on a daily feeding of from 7 to 8 lbs. continued for the same period. It apparently is true that although the dry plant is toxic it is not so poisonous as the green plant. There is some reason for believing that the leaves are more toxic than the stems, so that during the winter months, after many of the leaves have fallen, much more of the plant would have to be eaten before poisoning would occur.

No definite line of medicinal treatment can be recommended for poisoned animals. If live stock can be prevented from eating any considerable quantity of the plant and are removed to good pasture they are likely to recover. It appears that it is practicable, by digging, to destroy the plant in affected pastures.

Immunization against contagious abortion, A. GMINDER ET AL. (*Arb. Reichsgsndhtsamt., 52 (1920), No. 3, pp. 375–467, fig. 1*).—This is the detailed report of the results obtained in an extensive application of various methods of immunizing against contagious abortion, partial data from which have been previously noted (E. S. R., 44, p. 879). The data obtained on 80 herds comprising 3,006 animals, of which 1,356 served as controls while 1,650 were vaccinated with the 5 vaccines noted in the previous report, are summarized as follows:

The total number of abortion cases fell from 25.21 to 15.15 per cent following vaccination, while during the same period the percentage of abortion in the controls rose from 16.31 to 22.68 per cent. The percentage distribution of the decrease in abortion cases due to the various vaccines was as follows: Following vaccination with killed cultures from 18.51 to 13.2 per cent, with killed cultures plus serum from 21.76 to 13.6, living cultures from 29.09 to 6.36, and living cultures plus serum 16.36 to 5.45.

Passive immunization of animals well along in pregnancy was unsuccessful, and conclusive results were not obtained with vaccination of such animals with attenuated cultures. It proved more difficult to immunize animals before than after puberty. Pregnant animals can be vaccinated at any time with killed cultures or living cultures plus immune serum (1:10) without effect on future pregnancy. Pregnancy favors the building of immune bodies in artificial immunization, as shown by the fact that noninfected pregnant animals were more easily immunized than nonpregnant animals.

Immunization with blackleg aggressin, T. P. HASLAM (*Jour. Immunol., 5 (1920), No. 6, pp. 539–546*).—The method of preparing the brain-liver-peptone broth used for checking the purity of blackleg aggressin (E. S. R., 40, p. 884) and the method of preparing blackleg aggressin are described, and data are given on immunization experiments conducted on guinea pigs and calves.

The brain medium, which is said to be much more delicate and more dependable than guinea pigs as a test for the presence of *Bacillus chauveaui* in blackleg aggressin, is prepared by gradually heating to boiling 500 gm. of finely ground liver in 1 liter of water and cooking about 30 minutes or until the liquid is clear. The clear broth is decanted, mixed with 1 per cent peptone and 0.5 salt, and adjusted to an H-ion concentration of pH=8. It is then mixed with brain tissue (amount not stated) which has been ground, heated at 3 lbs. pressure for 1½ hours, and the whole autoclaved at 6 lbs. for 3 hours. The aggressin is prepared from the edematous fluid of calves dying in 1 to 3 days after inoculation with a pure culture of *B. chauveaui*. This fluid, which is obtained by pressing the affected tissue, is cooled, centrifuged, and filtered through Berkfeld and Mandler filters. The sterility of the aggressin is tested by adding a sample of at least 10 cc. to each of 3 brain flasks containing 250 cc. of medium and incubating for at least 60 hours. Absence of toxicity is established by inoculating guinea pigs with 10 cc. of the aggressin or calves with 50 to 100 cc.

The immunity conferred on guinea pigs by blackleg aggressin was found to be proportional, within limits, to the size of the dose given. Ten cc. of blackleg aggressin immunized about 80 per cent of the guinea pigs tested against 5 lethal doses of pure culture virus. In calves also the immunity was found to depend upon the amount of aggressin given and the potency of the virus used

in testing. In experiments in which the virus was strong enough to cause a marked reaction in the protected calves, 74 per cent of the animals receiving 5 cc. of blackleg aggressin were immune to 5 cc. of pure culture virus.

The practical value of the complement deviation method for the diagnosis of equine dourine, I. O. WALDMANN and P. KNUTH (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 24, pp. 269–271*).—This is chiefly a review of the literature on the use of the complement deviation reaction for the detection of dourine, with brief mention of experimental evidence leading the author to confirm the favorable reports of others. An extensive list of literature references is appended.

The serodiagnosis of dourine.—II, The lipoid fixation reaction, H. DAHMEN (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 45, p. 532*).—This paper continues the series of studies on the diagnosis of dourine noted above by the report of a study of the diagnostic value of the lipoid fixation reaction according to the technique of Meinicke and Bley (E. S. R., 43, p. 277.)

The reaction was found to agree closely with, and in some cases to be even more delicate than, the complement fixation reaction. Heating the serum to 51° C. for half an hour did not destroy its value, but heating to 55° for 15 minutes rendered it inactive. A 3 per cent salt solution proved the best concentration.

A new serological method for the detection of infectious diseases (The serodiagnosis of dourine, III), H. DAHMEN (*Berlin. Tierärztl. Wchnschr., 37 (1921), No. 3, pp. 31, 32*).—A new method for the detection of dourine and of possible application to other diseases is described under the name of "precipitation phenomenon." The method is essentially a more delicate lipoid fixation test involving the Tyndall phenomenon or the illumination of the turbidity by a single beam of light. The technique as applied to dourine is as follows:

Fresh, washed trypanosome material is dried at from 50 to 55° C. and ground to a fine powder in a mortar. To 0.1 cc. of this powder is added 1 cc. of ether and the whole shaken for an hour, after which the ether is filtered off and the residue dried in the incubator at 37°. To the dry residue is added 1 cc. of absolute alcohol and the extraction continued for 3 days with occasional shaking, after which the liquid is centrifuged and the clear liquid transferred to a small flask which is kept cool and dark. In a flat bottom glass from 7 to 10 cc. high and 2.5 to 3 cc. in diameter are placed 25 cc. of an 0.9 or 1.5 per cent salt solution and 0.15 cc. of the extract obtained as above. Care should be taken that this solution contains no particles of air. The salt solution should be poured in through a funnel, the stem of which rests against the side of the glass, and the extract should be added with a pipette.

The test consists in dropping on the surface of this optically clear solution a drop (0.04 cc.) of fresh serum which has been centrifuged for 10 minutes at 3,000 revolutions. The serum of animals affected with dourine is said to form a smoky blue ring, while no ring is formed with negative serum. The same solution can be used several times if the ring is broken up each time by stirring with a clean rod. Tests with varying dilutions of serum gave positive results up to 1:100.

Oxygen chemotherapy in foot-and-mouth disease, N. MORI (*R. Ist. Incoragg. Napoli, Ann. Staz. Sper. Malattie Infett. Bestiame, 5 (1919), No. 2, pp. 119–128*).—The author reviews the literature on oxido-therapy, and reports success with intravenous injections of hydrogen peroxid in the treatment of foot-and-mouth disease. The possibility is suggested of making use of similar treatment in immunization against the disease, the animal to receive inoculations of material from an infected animal, followed shortly after by subcuta-

neous injection of hydrogen peroxid, which may be repeated once or twice if necessary.

The cure of epizootic foot-and-mouth disease (*Mod. Zooiatro, 5. ser., 8 (1919), No. 6, p. 35*).—This is a copy of the directions issued by the experiment station for foot-and-mouth disease in Milan, Italy.

The preparation recommended consists of ether, 95 per cent alcohol, and physiological salt solution in equal parts, with 15 gm. of crystallized phenol to 100 parts of the above mixture. This preparation is injected subcutaneously in daily doses ranging from 20 to 30 cc. for large animals to 5 cc. for the smallest animals during the 4 or 5 days of acute infection, and then every other day for 5 or 6 days. As a preventive measure it is injected in amounts from 10.5 to 15 cc. every day for 5 or 6 days and then every other day until the period of infection is passed. In case of cardiac insufficiency at the end of the first febrile attack, recourse should be had to hypodermic injections of caffein 25 gm. and sodium benzoate 34 gm. in 100 cc. of distilled water, a dose of 10 cc. being used for large and medium-sized animals and 5 for small.

The station also provides an autolyzed antiaphthic vaccine to be used on healthy animals not exposed to immediate contagion. This is injected subcutaneously or intravenously in doses of from 10 to 20 cc., depending upon the size of the animal. After 8 days the inoculation is repeated with a double dose. The immunity thus acquired is not of long duration, but in a subsequent infection the disease takes a lighter course. Immune blood serum is used for animals of greater value. This is given intravenously in doses of from 100 to 200 cc. and repeated if necessary after 24 hours.

An experience in the cure of malignant foot-and-mouth disease, P. Crimi (*R. Ist. Incoragg. Napoli, Ann. Staz. Sper. Malattie Infett. Bestiame, 5 (1919), No. 2, pp. 111–118*).—From an actual test of the value of the alcohol-ether phenol solution noted above in the course of a severe epidemic of foot-and-mouth disease, the author concludes that the preparation has a beneficial action on infection of a malignant character, in that it attenuates the virulence and causes the infection to take a benign course, but that it does not shorten the period of the disease and is thought to be of no value as a preventive measure. The treatment has been found to confer no odor or taste to the milk or meat.

Glanders, Lührs (*Centbl. Bakt. [etc.], 1. Abt., Orig., 85 (1921), No. 6–7, pp. 76–97*).—This is a review and discussion of the extent of glanders in Germany during the war and of the various means used for the detection and treatment of the disease.

The diagnosis and control of glanders with the help of the mallein and blood reactions, C. Giese (*Arb. Reichsgsndhtsamt., 52 (1920), No. 3, pp. 468–500, figs. 12*).—This is a critical discussion of various means of diagnosing glanders, based upon the practical application during the war of the many tests described in the literature. From the experimental data presented the following conclusions are drawn:

Glanders can be most accurately diagnosed through the simultaneous application of the blood tests (agglutination and complement deviation) and the eye tests. For the examination of donkeys, mules, and hinnies the conglutination or hemagglutination test is of value. Essential for satisfactory results in the mallein eye test are good mallein and the early and repeated examination of the malleinized animals. As the result of repeated comparisons of the blood and eye tests, the subcutaneous mallein test is recommended for fever-free horses, mules, etc. For the interpretation of the subcutaneous test the results of thermal, local, and general reactions should be considered. A single application of the combined blood and eye tests is not enough. For accurate diagnosis the test should be applied several times.

An outbreak of infectious broncho-pneumonia among military horses in Belgium, 1915–16, F. Bösch (*Monatsh. Prakt. Tierheilk., 28 (1917), No. 7–8, pp. 273–361, figs. 8*).—The details of investigations conducted are here reported. The author found that in certain cases and in definite stages this affection resembled strangles, epizootic tracheo-laryngeal catarrh, and contagious pleuropneumonia; occasionally it resembled equine erysipelas and the affection described by Dieckerhoff as skalma. The disease is extremely contagious, affecting nearly all newly purchased animals, particularly the younger ones.

The paper includes a list of 48 references to the literature.

Two lipoid reactions for the diagnosis of bovine pleuropneumonia, H. Dahmen (*Berlin. Tierärztl. Wchnschr., 37 (1921), No. 7, pp. 73–75*).—The precipitation phenomenon and lipoid fixation reactions noted on page 785 have been found of practical value in the diagnosis of bovine pleuropneumonia.

The prevention and cure of exudative pleuropneumonia in goats by means of a special serum extracted from the specific pleural exudate, N. Mori (*R. Ist. Incoragg. Napoli, Ann. Staz. Sper. Malattie Infett. Bestiame, 5 (1918), No. 1, pp. 3–15*).—A further investigation on the value of specific serum treatment of exudative pleuropneumonia of goats (E. S. R., 40, p. 888) is reported.

Tests of the value of various exudates from diseased animals showed a hemorrhagic exudate to be not only valueless but harmful. With this exception and with the precaution that the exudate be received and used fresh, the various exudates obtained were all effective in the treatment of the disease and in conferring immunity lasting about a year. The recommended dosage is from 5 to 6 cc., which may be repeated if necessary.

The use of serum for strangles, H. W. Schiphorst (*Die Bekämpfung der Druse Mittels Serums. Inaug. Diss., Univ. Bern, 1918, pp. 30*).—This dissertation consists of an extensive review of the literature on strangles, followed by data on the preparation and use of a polyvalent serum. This is prepared by inoculating a healthy horse with gradually increasing doses of a 24-hour culture in serum bouillon of several strains of strangles streptococci. The initial dose of 5 cc. injected intravenously is followed at intervals of 2 weeks with 2 doses of 10 cc., 1 of 15, 1 of 25, 1 of 30, 1 of 40, and 1 of 50, and then 50 cc. every 2 weeks until 500 cc. have been injected. The animal is then ready for withdrawal of blood for the preparation of the serum, but receives an additional 50 cc. of the culture every 6 weeks.

In addition to reports of the successful use of serum thus prepared in the Imperial Serum Institute of Rotterdam, the author reports success with its use in 28 cases of curative and 10 preventive vaccination. As a curative measure one injection of from 60 to 120 cc. in general proved sufficient, although in 4 cases two injections were required and in one case four. As a preventive measure one injection of 100 cc. proved sufficient.

A tuberculous infection of pigeons determined by a special microorganism, P. Crimi (*R. Inst. Incoragg. Napoli, Ann. Staz. Sper. Malattie Infett. Bestiame, 5 (1919), No. 2, pp. 129–222, figs. 12*).—This is the detailed report of an extensive investigation of tuberculosis among pigeons, the report including the biological and biochemical properties of the causative agent, which has been given the provisional name *Bacillus tuberculigenus columbarum*, the results of immunization experiments, and a classification of tuberculosis in general and of avian tuberculosis in particular.

Active immunization was secured by the use of living attenuated organisms and with the specific exudate and bacterial extract and passive immunization by the injection of serum from an actively immunized guinea pig. Immunity

is not transferred from mother to fetus nor from mother to offspring through the milk.

The spread of tuberculosis among cattle, W. SEIFERT (*Ztschr. Tuberkulose, 32 (1920), No. 5, pp. 283–294, figs. 2*).—This completes the report previously noted (E. S. R., 44, p. 580), statistics being given as to the extent of tuberculosis in Belgium, Great Britain, France, Italy, Portugal, the Balkan Peninsula, Russia, Finland, the Asiatic countries, Australia, North America, Central and South America, and Africa. In conclusion the data presented are summarized graphically, showing the relative amount of bovine tuberculosis in different countries as judged by slaughterhouse findings and by the tuberculin test.

Salpingitis in the cow.—I, The streptococcus as a possible etiological factor, C. M. CARPENTER, W. W. WILLIAMS, and H. L. GILMAN (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 2, pp. 173–183*).—In the investigations conducted, the bacteriology of the oviducts of 43 animals slaughtered because of sterility has been completed.

In 14 of 17 which came from one of the larger herds, *Streptococcus viridans* has been isolated either from the tubes or from the adhesions adjacent to them. In 2 cases *S. hemolyticus* was recovered associated with *S. viridans*. "Staphylococci were mixed with the *S. viridans* cultures in 7 instances, and an unidentified organism was recovered once. In 1 case *S. viridans* was not found in the oviducts, but a culture with the same characteristics was isolated from the uterus. The remaining 26 animals came from 12 different herds. Streptococci were isolated from 14 cases, the majority of these being of the *S. viridans* type. Staphylococci were recovered from 9 cases, occasionally in pure culture but mixed as a rule with the streptococci. Twice, organisms from the colon-aerogenes group were recovered. In 6 cases no organisms were isolated from the tubes."

The two cases reported are said to represent the typical history and clinical and laboratory findings of most of the animals examined.

Intestinal necrobacillosis, W. W. DIMOCK (*North Amer. Vet., 2 (1921), No. 2, pp. 80–83*).—In the discussion of this subject, which is based upon experimental work at the Kentucky Experiment Station, it is pointed out that the loss of 50 per cent of the shotes of a herd suffering with intestinal necrobacillosis, or infectious necrotic enteritis, is about what may be expected on badly infected premises. Vaccination has not given the results that were at first anticipated. Until the primary and predisposing causes of the disease are determined and an effective vaccine is developed, it is thought that medical treatment should be attempted, accompanied by strict sanitary precautions. The results obtained from the use of several medicinal agents are briefly reported upon. It is thought that the colony system of keeping the brood sows is one of the best solutions for the control of the disease.

Pig parasites and thumps, B. H. RANSOM (*U. S. Dept. Agr. Yearbook 1920, pp. 175–180, figs. 3*).—This is a popular presentation of the knowledge of *Ascaris lumbricoides*, which is shown to be a cause of thumps in young pigs, based upon investigations previously noted (E. S. R., 43, p. 275).

RURAL ENGINEERING.

Irrigation: Its principles and practice as a branch of engineering, H. BROWN (*London: Constable & Co., Ltd., 1920, 3. ed., rev., pp. XV+305, pls. 9, figs. 68*).—This is the third revised edition of this work (E. S. R., 27, p. 686). Additional matter is included on means of drawing on the water supply and on flood banks, together with an appendix.

With the irrigation farmer, S. FORTIER (*U. S. Dept. Agr. Yearbook 1920, pp. 203–216, figs. 3*).—A popular account is given of the work of the Irrigation Investigations Division of the Bureau of Public Roads on the practical phases of irrigation.

Easy method of determining discharge over weir having velocity of approach, W. G. STEWARD and E. H. COFFIN (*Reclam. Rec.* [*U. S.*], *12* (*1921*), *No. 6, pp. 276, 277, fig. 1*).—Experiments conducted on the Boise project of the U. S. Reclamation Service are reported, in which it was found that the flow over weirs having velocity of approach can be determined closely by the use of the ordinary enameled weir scale. The scale is placed on and near the center of the crest of the weir in a perpendicular position, with the thin edge cutting the water, and the broad side is then suddenly turned against the flow of water and the height to which the water rises on the scale noted. It was found that the discharge given by the weir table for this height is very nearly accurate. In all the experiments the scale gave a higher reading than the gauge nailed on the side of the structure, but if the discharge was held constant and the weir pool thoroughly cleaned so as to give good conditions, both the gauge and the scale, as held on the center of the crest, gave the same results.

New method of determining efficiency of centrifugal pumps, A. F. SHERZER (*Engin. News-Rec., 86* (*1921*), *No. 26, pp. 1114, 1115, figs. 3*).—In a contribution from the University of Michigan, graphic data are reported from a large number of experiments with centrifugal pumps showing their efficiencies in terms of gallons per minute and specific speeds. Specific speed is defined as the speed in revolutions per minute at which the pump will revolve when discharging 1 gal. per minute against a head of 1 ft., and is indicated by the expression $Ns=\frac{N\sqrt{GPM}}{H\,3/4}$, in which Ns is the specific speed, H is the head for maximum efficiency, N is the actual speed, and GPM is the discharge of the pump in gallons per minute for maximum efficiency.

Fluorescein an aid to tracing waters underground, H. STABLER (*Reclam. Rec.* [*U. S.*], *12* (*1921*), *No. 3, pp. 122, 123*).—The results of a series of four experiments on the use of fluorescein in the tracing of underground waters are briefly reported.

Fluorescein was placed in different amounts in streams which disappeared underground, usually in sink holes. The chemical was detected at the outlets of underground streams flowing at distances of 12,000, 4,000, 450, and 2,500 ft. from the points at which the water was originally treated. It is stated that in general the dose of fluorescein should be computed to give about 1 part in 10,000,000 in the effluent if results visible to the naked eye are desired.

The proper method in tracing underground waters is to dissolve the calculated dose of fluorescein in a small quantity of water and place it in a single charge at the point where the water disappears underground. Then watch all possible springs or wells for results, collecting samples and examining them in a long tube of colorless glass at reasonably frequent intervals. Seepage from a canal can be traced by placing fluorescein in pits or borings alongside or in the bed of the canal.

Surface water supply of the North Atlantic slope drainage basins, 1918 (*U. S. Geol. Survey, Water-Supply Paper 471* (*1921*), *pp. 183+XXXVII, pls. 2, fig. 1*).—This report, prepared in cooperation with the States of Maine, Vermont, Massachusetts, and New York, presents the results of measurements of flow made on streams in the North Atlantic slope during the year ended September 30, 1918.

Ground water in the Southington-Granby area, Conn., H. S. PALMER (*U. S. Geol. Survey, Water-Supply Paper 466 (1921), pp. 219, pls. 7, figs. 30*).—This report, prepared in cooperation with the Connecticut Geological and Natural History Survey, deals with the ground water supplies of an area of over 500 square miles, lying partly in the central lowland physiographic province and partly in the western highland province of Connecticut.

Information is given concerning municipal water supplies, dug wells in rural districts, the general features of drilled and driven wells and springs, and the quality of the waters.

Analyses of samples of waters from different sources show that the schist waters are in general the best, and that the till and stratified drift waters are both nearly as good. The sandstone waters contain comparatively large amounts of iron, calcium, magnesium, bicarbonates, and scale-forming ingredients. The data from assays corroborate those from analyses except that they indicate no great difference in quality between sandstone waters and stratified drift waters.

Third biennial report of the State Water Commission of California, 1919–1920, C. H. LEE ET AL. (*Calif. State Water Comn. Bien. Rpt., 3 (1919–20), pp. 176, pls. 2, figs. 36*).—The work and expenditures of the California State Water Commission for the period from September 1, 1918, to September 1, 1920, are reported. A number of appendixes are included, some of which deal with irrigation investigations.

Highway engineering: Rural roads and pavements, G. R. CHATBURN (*New York: John Wiley & Sons, Inc., 1921, pp. XII+379, pl. 1, figs. 189*).—This volume is more especially concerned with those types of roads most common in the rural districts, small cities, and towns. Pavements are treated largely with a view to their use for country roads. The author is of the opinion that almost all of the principles of road building applicable to rural highways are equally applicable to city streets, and vice versa.

A method of calculating mixtures to conform to the Fuller maximum density curve for concrete, the New York sheet asphalt mixture, or any other selected or predetermined sieve analysis design is given, which the author considers to be both original and mathematically correct. He also illustrates his straight-line method for plotting granulometric analyses, and tentative methods for testing sand-clay mixtures are included. A graded mixture for gravel roads based on the maximum density curve is suggested.

Considerable space is devoted to the surveying and location of roads. Other important chapters included are those on types and adaptation of roads, drainage, culverts and bridges, gravel and broken stone roads, pavement foundations, concrete and bituminous roads, dust prevention, and revenue administration and organization.

Roads, H. S. FAIRBANK (*U. S. Dept. Agr. Yearbook 1920, pp. 339–352, figs. 6*).—A brief history is given of the activities of the Bureau of Public Roads since its beginning, special attention being briefly drawn to some of the more important features of research in progress.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 4, pp. 27, figs. 8*).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in June, 1921, together with the status of Federal aid as of June 30, and the following articles:

Federal Bureau to Make Survey of Road Mileage and Revenues; Semipermanent Guard Fence Built on Federal-Aid Roads, by C. L. McKesson; Direction and Warning Signs are Standardized in England; Maryland Markers Explain Laws and Protect Travelers, by H. D. Williar, jr.; Fine Particles Removed from Sand by Centrifugal Blower, by C. H. Sweetser; and Grading to Help Nature Clear the Roads of Snow, by B. B. Hauser.

Tests show increased efficiency in windmill performance, A. F. Moiir (*Agr. Engin., 2 (1921), No. 5, pp. 99–101, figs. 4*).—Tests of two 8-ft. windmills, mounted on separate 50 ft. towers, to determine the efficiency of antifriction bearings are reported. Although the average wind velocity during the tests on the mill with plain bearings was a trifle higher than during the tests on the mill with antifriction bearings, the latter showed nearly four strokes more per minute and delivered 34.9 per cent more water than the mill with plain bearings.

A test lasting 370 hours on two 10-ft. mills of the direct-drive type, mounted on 70-ft. towers, showed that although two antifriction bearings were put in the place of two plain bearings on the main shaft, covering only one-half of the places where friction occurs, the mill so fitted pumped 14 per cent more water than the other mill. It was also noted that the antifriction bearing mill would start to pump a considerable period before the plain bearing mill, and when the velocity was low the amount of water pumped was as much as 50 per cent greater. As the velocity of the wind increased, the increase in water pumped became gradually less.

[Mowing machine experiments], F. W. Duffee (*Farm Mechanics, 5 (1921), No. 2, pp. 12–14, figs. 5*).—Experiments conducted at the Wisconsin Experiment Station to determine the draft of a mowing machine under different conditions are reported.

When the cutter bar was in first-class condition with the worn parts replaced and properly aligned and the knife sharp, the draft was 297 lbs. With the knife comparatively sharp but the rest of the bar worn, the draft was increased 99 lbs., and with the knife fully dulled and the bar in good condition it was increased 101 lbs. These results are taken to indicate the great saving which is made by a sharp sickle as compared with a dull one, but it is concluded from the field tests that the knife is of about the same importance as the other parts of the cutter bar. It was also found of great importance that the cutter bar be properly aligned, and that the length of the pitman should be such that the sections center in their respective guards at each end of the stroke either way.

Sunshine and sanitation for hog houses, W. A. Foster and J. M. Evvard (*Iowa Sta. Bul. 194 (1921), pp. 257–296, figs. 48*).—This bulletin emphasizes and explains briefly the health essentials of hog houses, and reports data to demonstrate how sunshine and sanitation can be provided, with particular reference to the State of Iowa. A latitude map of the State is given, together with a table showing heights of windows for sunlight for given latitudes and farrowing seasons.

Diagrams are also given from sunlight studies showing differences in height of windows applicable to different parts of the State and the position of the sun's rays at various periods through windows of different types of hog houses in central Iowa. Methods of location of roof windows are also described.

Brief information on ventilating and drainage is included.

The adobe milk house, C. B. Brown (*Arizona Sta. Circ. 38 (1921), pp. 4, figs. 3*).—Popular information is given on the construction of an adobe milk house, including specifications and diagrammatic illustrations.

The design of farm elevators, W. G. Kaiser and W. A. Foster (*Agr. Engin., 2 (1921), No. 3, pp. 51–56, figs. 13*).—Considerable information on the design of farm elevators is summarized in this report, much of which has been obtained from the results of work of others and some from actual investigation.

It is pointed out that the circular form of crib for corn is especially suited to masonry structures. A rectangular structure with two driveways and three

cribs is one in which more corn and grain can be handled by one conveyor system. The thickness of corn in cribs was found to vary for different communities, ranging from 5 ft. to 9 ft. 6 in. In the eastern part of the Middle West the width varies from 5 ft. to 7 ft. 6 in., while the greater width is found in the corn belt. The greater width is considered to be satisfactory in a normal year but unsatisfactory for soft corn. In general, it is considered well to provide at least 20 per cent openings for ventilation under average conditions.

From studies of the pressure of corn and grain in bins, the following conclusions are drawn: The pressure of grain on bin walls and bottoms follows a so-called semifluid law, which is entirely different from the law of the pressure of fluids. The lateral pressure of grain on bin walls is less than the vertical pressure, and increases very little after a depth of from two and one-half to three times the width or diameter of the bin is reached. The ratio of lateral to vertical pressures is not constant, but varies with different grains and bins and can only be determined by experiments.

The pressure of moving grain is very slightly greater than the pressure of grain at rest, the maximum variation for ordinary conditions being probably 10 per cent. Discharge gates in bins should be located at or near the center, as if the gates are located in the sides of bins the lateral pressure due to moving grain is decreased near the discharge gate and materially increased on the side opposite the gate. For common conditions this increased pressure may be two or four times the lateral pressure of grain at rest. Tie rods decrease the flow, but do not materially affect the pressure.

The maximum lateral pressures occur immediately after filling and are slightly greater in a bin filled rapidly than in a bin filled slowly. Maximum lateral pressures occur in deep bins during filling. The calculated pressures by either Janssen's or Airy's formulas agree very closely with actual pressures. The unit pressures determined on small surfaces agree very closely with unit pressures on large surfaces.

Grain bins designed by the fluid theory are in many cases unsafe, as no provision is made for the side walls to carry the weight of the grain. Calculation of the strength of wooden bins that have been in successful operation shows that the fluid theory is untenable, while steel bins designed according to the fluid theory have failed by crippling of the side plates.

[Concrete grain elevators], A. J. R. CURTIS (*Concrete [Detroit], 18 (1921), No. 6, pp. 268–271, figs. 7*).—Working data are given on the design of reinforced-concrete grain elevators, including tables showing the capacities of circular grain bins and tanks in bushels and the amounts of reinforcing steel required for circular and square tanks.

The theory and practice of sanitation in country places, including the bacteriolytic tank system, W. R. SMITH (*Adelaide: R. E. E. Rogers, 1920, pp. 36, pls. 12*).—This is the fifth edition of this publication, containing the summarized results of a large amount of experience on the use of residential methods of sewage disposal, and evidently written from the Australian viewpoint.

Special attention is devoted to the so-called bacteriolytic tank system, which consists primarily of a combination of settling and septic tank and ventilation system. The results of experience are said to indicate that the bacteriolytic tank should be lined with concrete and should have a capacity as nearly as possible to 24 hours' sewage. It is considered unnecessary to filter or otherwise separate the constituents of sewage before it passes into the tank. The compartment may be open or closed, but if closed they should be ventilated so as to allow a constant supply of air to the second compartment.

It is further stated that filtration materials have proved unnecessary and are sometimes a source of trouble. The resulting liquid may be passed on to the soil or allowed to soak into the subsoil by means of catch wells or drains. It is stated that there is evidence to show that these tanks favor the destruction rather than the growth of germs of typhoid and other diseases.

Straw filters for sewage purification, E. H. RICHARDS and M. G. WEEKES (*Surveyor and Munic. and County Engin., 60 (1921), No. 1539, pp. 47, 48*).—Laboratory experiments conducted at the Rothamsted Experimental Station are reported, in which a dilute solution of ammonium carbonate equal in strength to a very strong sewage was passed through a percolating filter of wheat straw at the rate of 250 gal. per cubic yard of straw per day. On the first day 5 per cent of the nitrogen passed on to the filter was removed, and the amount increased steadily up to the twentieth day, when only 1 per cent of the nitrogen in the artificial sewage was found in the effluent, the remaining 99 per cent remaining in the filter. The filter was then mature, and continued to remove practically all the nitrogen fed to it until the saturation point was reached when 7 parts had been fixed per 1,000 parts of dry straw. On dismantling the filter the straw was found to have retained 86 per cent of the nitrogen contained in the original ammonia solution. Twenty per cent of the dry matter in the straw had disappeared in the process of fixation, so that the nitrogen in the final dry matter had been raised to 1.33 per cent. The effluent was brown colored but nonputrefactive.

The experiments were repeated with actual sewage, and the same results were obtained. When the straw became saturated with nitrogen it could be removed from the filter and if stored in heaps continued to ferment with great improvement in its physical state as a substitute for barnyard manure.

In further experiments it was attempted to apply straw filtration in the disposal of the sewage from a land reclamation camp containing 300 persons. The sewage consisted of urine, cookhouse, and ablution waters, and was considered to be of excessive concentration. The original experiments had made it clear that clean straw was not active in removing nitrogen, but that it gradually became more so as sewage was passed through it, the best results being obtained after 20 days of treatment. For this reason it was decided that the filter must be in sections and that the straw must be passed from section to section, so that the sewage always met the newest straw first and finished by passing through the most active section. Three sections were deemed sufficient, as this gave one section fully active and another nearly so when clean straw had to be added. After considerable experimentation a filter was designed in which the rate of sewage effluent flow to the straw was 96 gal. per cubic yard per day. With this scheme the best purification as measured by the five days' dissolved oxygen test was 80 per cent.

When a new tank of 960 gal. capacity was installed, the improvement in nitrogen recovery was very marked. The best figure recorded was 65 per cent of the nitrogen in the sewage. On incubation for five days the effluent was invariably putrid. From such a strong liquor, ten times as strong as normal sewage, it is considered probably impossible to produce a nonputrescible effluent by straw filtration alone.

It is concluded that in order to recover all the nitrogen possible from such sewage about 2 lbs. of dry straw per person per day is required. While 2,800 lbs. of dry straw were used during a period of 35 days for the treatment of sewage containing 49 lbs. of nitrogen, it was found by laboratory experiments that 5,000 lbs. of straw are actually necessary to recover this amount of nitrogen. "Even if the rate of flow had been low enough to allow proper biologi-

cal action, only about half the nitrogen could have been recovered. The straw removed was, in fact, overloaded with nitrogen all through the experiment. The resulting manure, after storage in a heap alongside the filter, was of excellent quality, containing 2.06 per cent of nitrogen, and was in good condition for applying to the soil. This manure has no smell whatsoever."

A study of the biology of the sprinkling sewage filter, J. W. THOMSON (*New Jersey Stas. Bul. 352 (1921), pp. 5–34, figs. 18*).—The results of a study conducted to gain a more definite knowledge of the relationship of the biological oxidative process in a sprinkling sewage filter and the gelatinous film present on the filter surfaces are reported. A special study was made of the organisms inhabiting the filter film.

It was found that organisms are present in the film of the sewage filter similar to those occurring in the soil and act to oxidize nitrogen from the ammonia to the nitrite and from the nitrite into the nitrate form. This process is a gradual one, starting in the top layer of the filter with the zone of greatest activity lying in the second layer.

A rapid decrease in the bacterial content of the sewage was found to occur as it passed over the stones of the filter, and at the same time there was a proportional increase in the bacterial content of the filter film. This result is taken to bear out the statement that the theory of absorption would apply to microscopic organisms as well as to complex chemical compounds. A very definite relationship was also established between the larger organisms inhabiting the film and the chemical activity of the filter.

Enzyms were found to be present in the film, acting to break up proteins into their more simple amino compounds and these amino compounds eventually into ammonia. It was also definitely proved that enzyms are present which act to break down maltose, dextrose, and sucrose, but no lactose-splitting enzym was found. A very active urease which split urea into ammonia and carbon dioxid was also found.

RURAL ECONOMICS AND SOCIOLOGY.

Organizing the farm business, A. BOSS (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 36–40, fig. 1*).—The size of farm business, particularly as measured by capital invested and the number of hours of productive labor performed by men and horses, as well as the farm layout and the quality and quantity of crops and live stock produced, are discussed.

Wages of management, J. A. HOPKINS, JR. (*Jour. Farm. Econ., 3 (1921), No. 2, pp. 82–90*).—The author presents a method of calculating wages of management which is intended to eliminate the effect of seasonal or temporary fluctuations of the market, as well as elements of chance, and to arrive at a single term which will permit a direct comparison of the success of different farmers or types of farmers. It is drawn up from the point of view of dairy farming. The method proposed would proceed as follows:

"(1) The total of expenses (no allowance for wages of management or supervision being included) is first computed and reduced to a cost per quart basis. (2) The dairies are then arranged in order of the cost per quart, so found, and the point at which the increase in cost for a given increment of product becomes most marked is taken as establishing the normal cost, or the bulk-line cost. This is usually at a point below which about 70 per cent to 80 per cent of the milk is produced. (3) From the table set up for (2), the interquartile range in cost of production is found. . . . (4) Next arrange the dairies in order of the cost of feed per quart of milk, and find the interquartile range for that. (5) Divide the interquartile range of cost of production per quart by that of

cost of feed per quart of milk. . . . (6) Ascertain the bulk-line cost of feed per quart of milk. . . . (7) The factor obtained in (5) is now to be applied to each individual dairy, according to its position above or below the bulk line for cost of feed per quart of milk.

"Now, letting *W* represent wages of management, *Q* the interquartile range of normal cost, *R* the interquartile range of cost of feed per quart of milk, and *X* the difference between the bulk-line cost of feed per quart and the cost of feed per quart in a given dairy; then the equation for wages of management in that dairy may be represented as: $W=\left(\frac{Q}{R}\right)X$. But the factor (Q/R) is constant for a given study, and will need only to be multiplied by X for any particular dairy."

Helping landless farmers to own farms, L. C. Gray (*U. S. Dept. Agr. Yearbook 1920, pp. 271–288, figs. 3*).—This article briefly sets forth increases in land values since 1850, the increasing scarcity in new lands in the United States, and the small percentage that the ordinary return is of the total value of farming land as the chief difficulties in the way of the tenants acquiring land ownership. Data from several studies of the rate at which they become farm owners are cited.

The Federal farm-loan system is said to have been established on conservative lines so that it is not adapted to the needs of landless farmers in borrowing for the purchase of land, and no provision is made for making second-mortgage loans.

Four alternatives to allowing private land companies a free hand in the process of developing and settling on reserve agricultural areas are suggested, including State and Federal regulation of private land-selling agencies, dependence on a policy of courageous publicity to prevent abuses and stimulate the employment of the most successful methods, State or Federal colonization enterprises for experimental and demonstration purposes, or a comprehensive Government project of development and colonization.

Progress of northern Minnesota settlers, J. D. Black (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 26–29*).—Data collected in 1919 by the division of agricultural economics of the University of Minnesota, assisted by the U. S. Department of Agriculture and the State Department of Agriculture, in the course of visits to 547 settlers in 10 different areas selected so as to cover all the various conditions to be found in northern Minnesota, are tabulated and briefly summarized here. The average time since settlement was 4.7 years. Of the 547 settlers, 116 had been on their holdings one year or less, 248 from 2 to 5 years, 145 from 6 to 9 years, and 38 10 years or over.

Only records of successful settlement can be said to have been obtained. These settlers came to the region with an average net worth of $1,820. The 232 who made the usual progress, namely, $200 to $600 per year, had $1,250 to their credit. Those making more than $600 progress came with nearly twice this amount. It is pointed out that these records are not to be compared with the labor incomes noted for farmers in older farming regions, including, as they do, the increase in the value of the land; also it is said that they are not to be compared with city workers' incomes, but with their savings. Two hundred and thirty-seven of the settlers visited made over $600 per year, 35 made over $2,000 per year, while, on the other hand, a group of 34 had lost an average of $99 per year. Except for this low group, the rate of progress was consistently proportional to the net worth of the settler at the beginning. Communities that have been most willing to borrow money are said to have prospered most.

Farm development in the cut-over lands of northern Minnesota, C. G. WORSHAM (*Minn. Farmers' Inst. Ann. No. 33 (1920), pp. 15–26, figs. 5*).—Tables showing forest products sold by settlers in 1918, value of farm products used in the home, and crops grown, kind and number of live stock kept, amount of income from the farm and from outside receipts, and the distribution of labor income on farms grouped by number of acres cleared per farm, together with suggestions with reference to the selection of the farm, its development, and the selection of crops and live stock, are based on unpublished material from surveys which were briefly reported heretofore (E. S. R., 44, p. 787.)

Costs, profits, and practices of the can-house tomato industry in New Jersey, F. APP and A. G. WALLER (*New Jersey Stas. Bul. 353 (1921), pp. 85, figs. 18*).—This bulletin, published in cooperation with the Office of Farm Management and Farm Economics of the U. S. Department of Agriculture, is a compilation of statistics taken from the Department records and other official sources relating to the can-house tomato industry in the United Sates, with an interpretation and description of tomato production, especially in New Jersey.

It is brought out that New Jersey is the fourth State in the production of can-house tomatoes, producing approximately 100,000 tons annually from 20,000 to 25,000 acres, the yield being approximately 5 tons. The important tomato-producing counties in New Jersey are Burlington, Camden, Gloucester, Cumberland, and Salem. The acre yield is usually highest in Burlington County. The price that the farmer received for tomatoes increased from $6 per ton in 1900 to $30 in 1919, with a decrease to $24 in 1920 and $14 in 1921.

The return of capital invested by the canners in 1916 and 1917 varied from 66 per cent to 18 per cent, according to the Federal Trade Commission. From the same source it is noted that the return on capital invested by the tomato packers, exclusive of the canners of New Jersey, was 60 per cent for the year 1917.

A large portion of the crop is picked as job work, the pickers receiving 3 to 8 cts. a basket. The cost per acre of producing tomatoes was $119.26 in 1918, $118.41 in 1919, and $135.62 in 1920, and per ton $19.13, $56.56, and $22.34, respectively. Of the items of the cost of production, man labor was the greatest, representing 32.86 per cent for the 3-year period; horse labor, 14.42; fertilizer, 14.1; manure, 12.2; land rental, 8.21; machine labor, 4.61; and truck and tractor labor, 3.73 per cent. The extremes of costs vary from less than $14 to over $50 per ton; those of yields, from almost nothing to 16 tons per acre.

The ton costs were higher than the average cost of production on farms having 8 acres or less, but were lower on the farms with more than 8 acres. Labor and materials were used most efficiently in producing can-house tomatoes on farm areas of 8.1 acres or more. Over half of the farmers were growing 8 acres or less per farm, with a total acreage 25 to 30 per cent of the average for all farms, and a corresponding percentage of total production in tons.

Farmers who used cover crops produced larger yields per acre. The price of tomatoes increased more than the price of corn and potatoes in New Jersey during the war period.

It is suggested that the marketing of the can-house crop needs revision, which can probably be brought about by a marketing association of growers, owned and controlled by them.

The cost of a bushel of wheat, F. W. PECK (*U. S. Dept. Agr. Yearbook 1920, pp. 301–308, figs. 2*).—The idea of the "bulk-line" theory of cost of production in relation to price is presented here. Studies made so far in the Office of Farm Management and Farm Economics of cotton, winter-wheat, and

sugar-beet costs show that the price received by the producers in 1918 and 1919 approximated a bulk-line cost of from 75 to 80 per cent of the products produced on those farms. Variations in the net cost per bushel of winter wheat and spring wheat in 1919 are tabulated and illustrated.

The operating cost of power plows, H. SCHWANECKE (*Mitt. Deut. Landw. Gesell., 36 (1921), No. 6, pp. 90–97*).—A brief historical sketch of the introduction into Germany of power plows and the development of the home manufacture of them is given, together with notes on the advantages and disadvantages of several types of plows, in the endeavor to show whether or not such machinery is economically adapted to German agriculture. A study is reported of the costs of operating power plows of various types and of the number of days of horse labor required in plowing operations where teams were used on farms of several degrees of intensity. It is concluded that the use of power plows is to be preferred, and that the steam cable plows are most practicable, other conditions being equal, where the size of fields warrants their use.

Shall I buy a tractor? W. I. MEYERS (*Cornell Countryman, 18 (1921), No. 9, pp. 495–499, figs. 2*).—In order to obtain information in regard to some economic factors involved in power farming, personal visits were made by the author in May and June, 1920, to 87 tractor owners in southwestern Cayuga County, a general farming region, and in northern Monroe and Orleans Counties, a fruit region of New York State. Detailed records of costs and work done were obtained. In addition questionnaires were sent out to a large number of tractor owners in the State.

The average cost of operation in 1919 on the farms studied was $1.16 per hour without an operator and $1.66 with an operator. The average annual cost of tractor operation was $660 for tractor and operator. The largest single item was depreciation, amounting to $187.25 per tractor annually. Other costs were tractor operator $166.63, fuel $137.38, repairs $44.25, interest $39.72, work on the tractor by farm labor $38.94, lubrication $37.58, and other costs $8.25.

The average number of hours worked annually was 425 hours, of which 321 hours were drawbar work and 104 hours belt work. The number of hours worked ranged from 47 to 1,277 for the year.

In Cuyaga County the average size of tractor farms was 216.5 acres, with 153.9 acres in crop area. The average size of all farms in the county in 1918 was 91.6 acres and 56.8 in crop area.

The results of the survey indicate that, in general, these tractor owners consider them profitable for plowing and other drawbar work, but consider horses more economical for light, rapid field operations. Data are given showing the number of horses that would be required for the same amount of work in a day as a tractor. At the average rates of cost of horse labor per hour in 1919 on some New York farms the cost per hour of the tractor was equivalent to that of 4.8 horses. On the smaller farms, averaging 60 acres of crops, the owners estimated that their tractors displaced 1.9 horses per farm; while on the largest farms, averaging 308 acres of crops, it was estimated that 3.5 horses were displaced per farm.

Speculation in wheat, P. DE MONICAULT (*Jour. Agr. Prat., n. ser., 35 (1921), No. 16, pp. 308–310*).—The author urges a system of granaries to be directly controlled by farmers' organizations and to have storage, grading, selling, and banking functions. It is thought that such institutions would help combat speculation in the grain trade in France, which is said to be developing as a result of a lack of capital on the part of millers with which to conduct grain buying and selling as formerly.

The march of standardization, H. W. SAMSON (*U. S. Dept. Agr. Yearbook 1920, pp. 353–362, figs. 4*).—A brief review is given of the progress in the general adoption of standard grades in the marketing of farm products.

Know your markets, W. A. WHEELER and F. GEORGE (*U. S. Dept. Agr. Yearbook 1920, pp. 127–146, figs. 7*).—The various publications and other means by which Government market information of a general nature and with regard to special crops is disseminated are described here.

The farmer's interest in foreign markets, E. G. MONTGOMERY and C. L. LUEDTKE (*U. S. Dept. Agr. Yearbook 1920, pp. 495–503, figs. 3*).—The growing importance of knowing foreign markets is noted.

AGRICULTURAL EDUCATION.

Proceedings of the thirty-fourth annual convention of the Association of Land-Grant Colleges (*Assoc. Land-Grant Cols. Proc., 34 (1920), pp. 300*).—This embodies addresses and committee reports made at the convention at Springfield, Mass., October 19–22, 1920, many of which have been discussed editorially (E. S. R., 43, p. 701), including also the names of officers and committees, a list of the land-grant colleges, experiment stations, and extension services, and the revised constitution (E. S. R., 41, p. 601), minutes of the executive body, and other data. Mention may be made of the following papers which have not been noted heretofore: Accrediting Agriculture from the Normal Schools, by F. B. Mumford; Quantity and Quality of Teaching in the Agricultural College, by T. P. Cooper; The Need of Special Training for Extension Workers, by D. J. Crosby; Should the Graduate School of Agriculture be Revived? by J. L. Hills, suggesting the discontinuance of this project; What Should be the Character of Further Federal Legislation Providing Funds for Agricultural Research? by T. P. Cooper and R. W. Thatcher; Relation of Extension Work to the New Farm Bureau Movement, by R. K. Bliss; Should Extension Workers Aid in Organization of Farm Bureaus? by T. R. Bryant; Should Extension Work Have a Working Agreement, (*a*) With the County Agent, (*b*) With the County Farm Bureau or Other County Farmers' Organization? by M. S. McDowell; The Opportunity of the Land-Grant College in the Preparation of Teachers of Vocational and Secondary Agriculture, by A. R. Mann; Highway Engineering Research, by T. H. McDonald; Organization Among Farm Women in the South, by O. Powell; Rural School Supervisors, Women's Clubs, and County Short Courses, by N. K. Jones; Home Bureaus, by J. L. Bane; Woman's Organization in the Farm Bureau, by N. S. Knowles; Measuring Home Demonstration Work in Financial Terms, by A. E. Harris; Relation of Boys' and Girls' Club Work to Smith-Hughes Home Project Work, by G. L. Warren; The Home Project—A Method of Instruction in a Vocational Course in Home Economics, by G. Fisher; Girls' Club Work Program in New York, by N. H. McNeal; Cooperation Between the Home Economics Extension Program and the Public Health Nurse, by M. Sawyer; Cooperation Between Home Economics Extension and Public or Private Schools, by T. E. Kauffman; Cooperation Between Home Economics Extension and Commercial Projects, by R. M. Allen; The Research Worker in Home Economics, Courses Prerequisite, by H. B. Thompson; Home Making Teachers, Scope of Subjects in Training Courses, by A. E. Richardson; Supervised Postgraduate Experience in Hospitals as Student Dietitians, by O. Hall.

Boys' and girls' clubs enrich country life, C. B. SMITH and G. E. FARRELL (*U. S. Dept. Agr. Yearbook 1920, pp. 485–494, figs. 5*).—This report considers the number of members enrolled and the money value of crops and live stock

produced as measuring results of extension teaching through boys' and girls' clubs in the Northern and Western States. Attention is directed to the improvement in crops and live stock and the community development which are said to have resulted from this work.

Home demonstration bears fruit in the South, O. B. MARTIN and O. POWELL (*U. S. Dept. Agr. Yearbook 1920, pp. 111–126, figs. 4*).—The method of approach to extension teaching of vegetable and fruit gardening, poultry raising, and selection and preservation of food for farm families through girls' club work in the Southern States is set forth here. The constantly broadening scope of the work and the results as exemplified in improvements in rural homes and community social life are emphasized.

Home economics exhibits for county and community fairs, M. WILKERSON (*Illinois Sta. Circ. 247 (1921), pp. 24, figs. 8*).—The guiding principles underlying the contest or competitive, the standard display, and the interpretive types of exhibits of products of the home, household furnishings, equipment, and labor-saving devices are considered in these papers. Details of organization of committees on exhibits, displays, and general arrangements, as well as the judges necessary and convenient score cards to be used in the analysis of the product itself, are set forth. A number of sample score cards are reproduced.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1920, E. T. MEREDITH ET AL. (*U. S. Dept. Agr. Yearbook 1920, pp. 888, figs. 185*).—This contains the report of the Secretary of Agriculture; 29 special articles abstracted elsewhere in this issue; an appendix containing a directory of the agricultural colleges and experiment stations, the State officials in charge of agricultural and extension work, State forestry departments, extension specialists, and schools, and National and State live stock associations; and the usual statistics of the principal crops, farm animals and their products, the Federal meat inspection, imports and exports of agricultural products, crop summaries, estimated value of farm products, world production and export trade in important crops, miscellaneous information relating to various crops and to live stock, movement of farm produce, prices paid by farmers for miscellaneous articles, information pertaining to farm labor, farm and labor incomes, value of plow lands by States, sectional meat consumption in the United States, automobile and road statistics, railway freight tonnage for 1916–1919, rural and agricultural populations of the world and area of agricultural land by countries, area and utilization of the National Forests, etc.

Report of the Hettinger Substation for the years 1919 and 1920, U. J. DOWNEY (*North Dakota Sta. Bul. 150 (1921), pp. 15, figs. 5*).—This bulletin consists of reports for this substation for the years 1919 and 1920. The experimental data reported are for the most part abstracted on page 734 of this issue.

Bimonthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1921), No. 4, pp. 49–64, figs. 6*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Mouth Infection or So-called "Canker" in Poultry, by W. T. Johnson, and Fall Cropping, by M. E. McCollam.

Science seeks the farmer, L. C. EVERARD (*U. S. Dept. Agr. Yearbook 1920, pp. 105–110, figs. 3*).—Some of the ways in which the Department is seeking to bring its work directly to the farmer and his family are briefly noted and illustrated.

NOTES.

Nebraska University.—Stanley J. Marsden, a 1921 graduate of the Michigan College, has been appointed instructor in poultry husbandry.

Rhode Island Station.—F. P. Gross, jr., assistant in chemistry, has resigned.

Washington College and Station.—The division of chemistry of the station has moved into new and well-equipped laboratories in James Wilson Hall, otherwise known as the agricultural building.

Aubrey C. Hildreth, who has been doing graduate work in horticulture and assisting in teaching and station work at the University of Minnesota, has been appointed instructor in horticulture and assistant horticulturist in the station, beginning September 1.

Officers and Committees for 1922 of the Association of Land-grant Colleges.—The complete list of general officers selected at the New Orleans meeting, noted editorially in this issue, is as follows: President, T. D. Boyd of Louisiana; vice president, A. A. Potter of Indiana; secretary-treasurer, J. L. Hills of Vermont; and members of the executive committee, R. A. Pearson of Iowa, chairman; W. M. Riggs of South Carolina, A. F. Woods of Maryland, A. R. Mann of New York, and F. B. Mumford of Missouri.

For the various sections the officers are as follows: Agriculture, B. W. Kilgore of North Carolina chairman, E. J. Iddings of Idaho vice chairman, and R. K. Bliss of Iowa secretary; engineering, R. L. Sackett of Pennsylvania chairman and C. A. Jones of West Virginia secretary; and home economics, Louise Stanley of Missouri chairman and Faith R. Lanman of Ohio secretary. For the three subdivisions of the section of agriculture, A. Atkinson of Montana and H. L. Kent of New Mexico were chosen chairman and secretary, respectively, in that of resident teaching; T. D. Farrell of Kansas and B. Youngblood of Texas, chairman and secretary in experiment station work; and T. O. Walton of Texas and C. F. Monroe of New Mexico in extension work.

The changes in the standing committees were unusually numerous. On the committee on instruction in agriculture, home economics, and mechanic arts, A. Vivian of Ohio and President Boyd were appointed for three year terms, vice J. F. Duggar of Alabama and W. M. Riggs of South Carolina. R. D. Hetzel of New Hampshire was appointed to the committee on college organization and policy for three years and A. R. Mann of New York for two years, vice K. L. Butterfield of Massachusetts and R. W. Thatcher of New York, respectively, and L. D. Coffman of Minnesota to fill a vacancy of one year. C. A. Lory of Colorado became chairman. Director Youngblood succeeded B. W. Kilgore of North Carolina for three years on the committee on experiment station organization and policy, with E. W. Allen of this Office as chairman. G. I. Christie of Indiana became chairman of the committee on extension organization and policy, on which B. H. Crocheron of California and T. B. Symons of Maryland succeeded L. A. Clinton of New Jersey and W. W. Long of South Carolina for three year terms. The committee on military affairs was rechristened the committee on military organization and policy, S. Avery of Nebraska and President Riggs becoming new members for three years and W. B. Bizzell of Texas chairman. President Atkinson was appointed to the joint committee of projects and correlation of research. Other committee members and chairman were continued unchanged.

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EXPERIMENT STATION RECORD.

VOL. 45. ABSRACT NUMBER. No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Practical biological chemistry, G. BERTRAND and P. THOMAS, trans. by H. A. COLWELL (*London: G. Bell & Sons, Ltd., 1920, pp. XXXII+348, figs. 61*).—This is an English translation of the third French edition of this manual of practical biological chemistry. Of special interest is the detailed description, with accompanying tables, of Bertrand's method of estimating reducing sugars by boiling a known quantity of the sugar solution with excess of a standard solution of copper hydroxid, treating the precipitated cuprous oxid with an acid solution of ferric sulphate, and titrating the ferrous sulphate formed with potassium permanganate.

Enzyms are classified as hydrolases, giving rise to decomposition with fixation of water, oxidases, and clastases, producing disruption of the molecule without addition. Proteins are classified as proteins proper, proteids or compounds resulting from the union of a protein molecule with another chemical group (phosphoproteids, metalloproteids, etc.), and proteoids, a provisional group of bodies containing substances which, though allied in nature, can not be included under the previous headings (ossein, carotin, gelatin, etc.).

Handbook of chemistry and physics, compiled by C. D. HODGMAN, M. F. COOLBAUGH, and C. E. SENSEMAN (*Cleveland, Ohio: Chem. Rubber Co., 1920, 8. ed., pp. 711, figs. 4*).—This is the eighth revised edition of this useful reference book of chemical and physical data.

Technology of cellulose esters, E. C. WORDEN (*New York: D. Van Nostrand Co., 1921, vol. 1, pts. 1, pp. CXXV+664, figs. 41; 2, pp. CXVII+665–1565, figs. 100; 3, pp. CXVII+1567–2375, figs. 153; 4, pp. CXVII+2377–3086, figs. 2; 5, pp. 3087–3709*).—This is the first volume of an exhaustive treatise on the technology of cellulose esters. The first two of the five parts into which the volume is divided deal, respectively, with the raw materials, cellulose, starch, and cotton, and with the acids of nitration, nitric, sulphuric, and mixed acids. Part three discusses the theoretical aspects of the cellulose nitrates, their methods of manufacture, and the tests by which they may be recognized and standardized; part four gives brief descriptions of the historical development of commercial cellulose esters; and part five is devoted to a patent, subject, and author index. Extensive literature references are included.

Animal and vegetable fixed oils, fats, butters, and waxes, C. R. A. WRIGHT, rev. by C. A. MITCHELL (*London: Charles Griffin & Co., Ltd., 1921, 3. ed., rev. and enl., pp. XIII+939, pls. 3, figs. 180*).—In this third edition of this reference book on animal and vegetable oils, fats, and waxes, the aim of the original author has been followed as far as possible, the subject matter consist-

ing of general descriptions of the methods of obtaining fixed oils and fats from their natural sources, their practical applications and uses, and their principal physical and chemical properties and reactions. Among the changes from the preceding edition are the complete revision of the section dealing with margarin and a new chapter on hydrogenated oils. The reports of standard methods for sampling and examining commercial samples of vegetable fats and oils previously noted (E. S. R., 44, p. 412) are appended, together with a brief review of recent investigations on vitamins in relation to fats.

Tables of refractive indices.—II, Oils, fats, and waxes, R. KANTHACK, edited by J. N. GOLDSMITH (*London: Adam Hilger, Ltd., 1921, vol. 2, pp. VI+7–295*).—This volume, which is the second of the series on the refractive indices of technical substances (E. S. R., 42, p. 712), deals chiefly with the refractive indices of oils, fats, and waxes. In addition the compilation of data includes the refractive indices of various glycerids and fatty acids of interest to the oil chemist; the refractive indices of hardened, polymerized, and blown oils; the dispersion values of various oils, and tables of approximate temperature correction for fatty oils to reduce observations to a standard temperature and for the conversion of butter refractometer readings into refractive indices and vice versa. An extensive bibliography is included.

Yield and composition of wormwood oil from plants at various stages of growth during successive seasons, F. RABAK (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 536–538*).—This contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, consists of data on the yield of wormwood oil from fresh and dry flowering plants grown at the Arlington Experiment Farm during several successive years, and on the physical and chemical properties of the oil obtained from these plants during various stages of growth.

The yield of oil from the fresh herb during the flowering stage was found to vary greatly from year to year owing to varying climatic conditions. The best yield of oil was obtained under conditions of low precipitation, high temperature, and much sunshine. Drying of the plants before distillation invariably caused a reduction in the yield of oil, but an increase in the esterification of the oil. The ester constituents of the oils from the fresh herb over a period of years appeared to be in closer conformity than the alcoholic constituents. The highest yield of oil was obtained during the flowering period of the plants.

Precipitation of grain-curd casein from pasteurized milk, including sweet cream buttermilk, H. F. ZOLLER (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 510–514, fig. 1*).—This contribution from the Dairy Division, U. S. Department of Agriculture, supplementing the studies on technical casein previously noted (E. S. R., 44, p. 808), deals with the influence of varying factors upon the nature of the curd obtained from pasteurized milk by the normal grain-curd method described in the previous studies.

When the identical conditions of the grain curd precipitation were observed, the resulting curd was softer and the grains less definitely formed and much smaller than the normal type of curd from unheated milk. Attempts to overcome the marked differences in the physical nature of the curd by the use of organic acids, coprecipitants, or rennin proved impracticable. By increasing the temperature of precipitation to a degree dependent upon the pasteurization conditions to which the milk had been subjected, a curd of satisfactory texture could be obtained. Curves are given indicating the optimum precipitation temperatures for milk pasteurized at a constant temperature (63° C.) for varying lengths of time, and at a constant time of pasteurization (60 minutes) for varying degrees of heat.

A modification of the grain-curd process to be applied to heated milks in factory practices is outlined briefly, the essential differences in procedure consisting in heating the milk to a temperature indicated by the curves noted above. The use of centrifugals instead of drain racks and screw presses is strongly recommended for all except very small casein plants.

In the preliminary experiments on the use of the ordinary grain-curd method in the separation of casein from pasteurized milk, it was noted that when the curd was leached with water adjusted with hydrochloric acid to the isoelectric condition of casein (pH=4.6) there was a marked retrogression of the hydrogen ion. "This rapid decrease in acidity is attributed to the excessive precipitation of alkaline earth phosphates during pasteurization, and their subsequent resolution at the expense of the hydrogen ion as they are brought into ready contact by the soft dispersing curd. The great check in the rate of this retrogression wrought by using higher temperatures for precipitation is believed to be due to the engulfing of these precipitated phosphates by the firming of the curd, thus reducing the intimate contact between the solution and the phosphates."

The relations of H-ion concentration to the heat coagulation of proteins in Swiss cheese whey, Y. Okuda and H. F. Zoller (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 515–519, figs. 3*).—The optimum reaction for the heat coagulation of Swiss cheese whey, as determined electrometrically, was found to be at an H-ion concentration of pH=4.5. Electrometric and colorimetric (methyl red) determinations of the H-ion concentration of whey before and after heating were not consistent, the methyl red indication of pH changing in the opposite direction from that indicated by the hydrogen electrode. It is thought that not only methyl red, but any indicator covering this region of pH would prove unreliable for giving an indication of the proper reaction of whey.

Analyses of the curd obtained from the whey by heat coagulation at pH=4.5 and at pH=6.5 showed that at the former or optimum concentration there was more protein and less calcium phosphate than at the less favorable H-ion concentration. The importance is emphasized of employing this optimum reaction in the preparation from whey of lactalbumin, lactose, whey cheese, and protein-free milk.

Manganese in commonly grown legumes, J. S. Jones and D. E. Bullis (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 524, 525*).—Analytical data are reported from the Oregon Experiment Station of the manganese content of various legumes, both in the entire plant and in the several parts—stems, bloom, leaves, seeds, and pods. The method of analysis employed consisted in ashing the material in a silica dish without the use of an oxidizing agent, freeing the ash from chlorin by treating with a few drops of concentrated sulphuric acid, dissolving the ash in hot water, converting the manganese to permanganate by warming with ammonium persulphate and silver nitrate, and finally titrating the cooled permanganate solution with a dilute solution of sodium arsenate standardized against potassium permanganate.

The average manganese content for the several legumes when the entire plant is considered, in terms of milligrams of manganese per kilogram of air-dried material, was as follows: Vetch 42, red clover 33, alsike clover 68, alfalfa 23, field peas 33, sweet clover 27, and white clover 34. Data on the relative amounts in the different parts of the plant show the leaves to be richest in manganese.

A calculator for converting gas chain voltage into equivalent C_H or pH values, P. E. Klopsteg (*Science, n. ser., 54 (1921), No. 1390, pp. 153, 154*).—A brief description is given of a slide rule of the circular type designed for converting gas chain voltages at 25° C. into equivalent C_H or pH values with different types of reference electrodes. The slide rule is so constructed that

it can be used equally well when the reference electrode, instead of being the usual calomel half cell, is a hydrogen electrode of known potential relative to the standard solution in which it is immersed.

Note on the gasometric determination of nitrogen, R. L. STEHLE (*Jour. Biol. Chem., 47 (1921), No. 1, p. 11*).—The liberation of oxygen in the method of determining nitrogen previously noted (E. S. R., 45, p. 11) has been found to be due to the copper sulphate added to hasten the digestion. It is therefore, recommended that the copper sulphate be omitted in order to avoid the necessity of subsequent pyrogallate treatment.

Methods for determining the amount of colloidal materials in soils, C. J. MOORE, W. H. FRY, and H. E. MIDDLETON (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 527–530, figs. 2*).—In this preliminary paper the authors describe work which has been done at the Bureau of Soils, U. S. Department of Agriculture, in the preparation and examination of the colloidal matter from soil. The material, to which the name ultra clay has been given, was obtained as follows:

Twenty-five lbs. of soil and 125 lbs. of distilled water were placed in each churn of a battery of barrel-type churns. The churns were rotated for several hours and then allowed to remain at rest for 24 hours, after which the supernatant liquid was siphoned off into well-tinned milk cans. The turbid liquid was passed through a Sharples centrifuge and the opalescent liquid issuing from the centrifuge was next separated from the dispersing medium by batteries of Pasteur-Chamberland filter tubes. The colloidal material collecting on the outside of the tubes was purified by stirring with distilled water and drawing off the water by means of clean filter tubes.

The ultra clay thus obtained is said to give every evidence of being a true colloid. When moist it is very plastic and sticky and when dry is, up to 10 per cent, a stronger binding agent than Portland cement. "It seems evident, therefore, that ultra clay is the principal binding material of the soil, giving it plasticity, cohesiveness, or hardness according to the moisture content."

In an attempt to determine the quantity of colloidal matter or ultra clay in soils, two methods were developed, one based upon the absorption of a dry gas (ammonia) by a dry colloid, and the other upon the absorption of dye from true solution by an aqueous suspension of the material. Assuming that the absorption of ammonia and of dye by soils is due only to the colloids they contain, the difference in amounts absorbed before and after heating to such a temperature as will destroy the colloids would be a measure of the colloidal content of the soil. On this assumption determinations of the colloidal content of Susquehanna clay soil by absorption of ammonia and by absorption of malachite green oxalate gave the same results, 28.3 per cent.

"The fact that methods so entirely different in nature give the same results seems to justify confidence in them. There still remains the possibility that the pure colloid we are able to separate from the soil does not possess the same absorptive ability as the whole colloid of the soil. If the values found for the pure colloids separated from the soil are higher than for the whole colloid of the soil, our methods give low results, and vice versa. The possibility is remote, but the point will be further investigated."

The determination of dicyandiamid and of urea in fertilizers, E. JOHNSON (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 533–535, figs. 5*).—A volumetric method for the determination of dicyandiamid in fertilizers is described, the technique of which depends upon the formation of the double compound, silver picrate-dicyanoguanidin, $C_6H_2(NO_2)_3OAg.2C_4H_2N_4$, previously described by Harger (E. S. R., 44, p. 711) under conditions involving dilute solutions, low

temperature, and a large excess of picric acid. The di-compound is so insoluble and its conversion into the mono-compound so slow that the amount of standard silver solution required can be determined volumetrically. The technique is described in detail, together with certain corrections found necessary in the author's experience. Neither urea nor dicyandiamid affects the results obtained by this method, but when chlorids or soluble sulphids are present a blank test must be run by titrating the silver solution without the addition of picric acid.

A new method for the determination of urea in fertilizers and fertilizer mixtures is described, which depends upon the fact that urea forms a characteristic, difficulty-soluble salt with oxalic acid.

On the substitution of turbidimetry for nephelometry in certain biochemical methods of analysis, W. Denis (*Jour. Biol. Chem., 47 (1921), No. 1, pp. 27–31*).—As a result of a comparison of the results obtained by nephelometry and turbidity in the determination of calcium in blood by Lyman's method (E. S. R., 37, p. 207), of fat in blood and milk by the method of Bloor (E. S. R., 32, p. 312), and of phosphates by the strychnin molybdate precipitate by Pouget and Chouchak as modified by Kober and Egerer (E. S. R., 34, p. 409) and by Bloor (E. S. R., 40, p. 16), the author makes the suggestion that determinations of turbidity made by means of a colorimeter may with advantage be submitted for nephelometric readings. "The advantages of this procedure are twofold: First, as turbidimetric readings give quantitave results with large variations in concentration between standard and unknown, it is possible to omit the preparation of the large number of standards which have been found necessary in nephelometric work; second, it presents an additional use for the now universally owned colorimeter and in the case of many small laboratories would probably make the possession of a nephelometer unnecessary."

Further improvements in the nephelometer-colorimeter, P. A. Kober and R. E. Klett (*Jour. Biol. Chem., 47 (1921), No. 1, pp. 19–25, figs. 4*).—A modification of the latest type of Kober nephelometer-colorimeter (E. S. R., 37, p. 205) is described and illustrated. The new improvements in the model are said to have the following advantages: "(1) The elimination of the fatigue and annoyance due to stooping to read the scale of Duboscq instruments, (2) an enlarged and well illuminated scale read through an eyepiece of the same focal length as the telescope, (3) a more convenient position for the milled heads operating the stages, allowing for resting of the operator's arms, and (4) a micrometer arrangement for setting the zero point which can be locked in any position."

Improved Denigès test for the detection and determination of methanol in the presence of ethyl alcohol, R. M. Chapin (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 543–545*).—For determining methyl alcohol in the presence of ethyl alcohol, the author at the Bureau of Animal Industry, U. S. Department of Agriculture, has modified the Denigès test as improved by Elvove (E. S. R., 37, p. 111) by using 0.2 cc. of phosphoric acid (C. P. 85 per cent) previously diluted to 1 cc. for accuracy in measurement, and an oxidation period of 30 minutes instead of the 0.2 cc. of concentrated sulphuric acid and oxidation period of 3 minutes employed by Elvove. Detailed directions are given for the technique of the method, both as a quantitative and qualitative procedure, and procedures for the removal of certain interfering substances are outlined. The tests as described are adjusted to a minimum limit of 0.2 per cent of methyl alcohol in total alcohol.

New method for the volumetric determination of reducing sugars, A. Jonescu and V. Varcolici (*Ann. Chim. Analyt., 2. ser., 3 (1921), No. 8, pp.*

229–234).—The method described depends upon the reduction of yellow potassium ferrocyanid to colorless potassium ferrocyanid in alkaline solution by the reducing sugar according to the following reaction, in which R=the reducing sugar:

$$2K_3Fe(CN)_6+2KOH+R=2K_4Fe(CN)_6+H_2O+R-O.$$

The reagent is prepared by dissolving 46 gm. of potassuim ferricyanid and 46 gm. of potassium hydroxid in sufficient distilled water to make one liter of the solution. This is titrated with a 0.5 per cent solution of glucose until 10 cc. of the ferricyanid solution added to 20 cc. of water is decolorized by 10 cc. of the glucose solution. The technique of the procedure consists in adding to 10 cc. of the standardized reagent 20 cc. of water, heating to boiling, and adding the unknown sugar solution drop by drop from a burette to the point of complete decolorization. In the case of colored solutions 10 drops of a 1 per cent picric acid solution are added as an indicator, the end point being the formation of picramic acid. The application of the method to the determination of urinary sugar, lactose in milk, and reducing sugars in liquids of fermentation and secretion is discussed.

Determination of maltose and lactose in the presence of other reducing sugars by Barfoed's solution, L. Le Grand (*Ann. Chim. Analyt., 2. ser., 3 (1921), No. 8, pp. 240–244, fig. 1*).—The author has developed the technique of the Barfoed test so that it can be used as a quantitative method for determining maltose and lactose in the presence of other reducing sugars. The technique is as follows:

The Barfoed solution is prepared by dissolving 20 gm. of commercial neutral copper acetate in 300 cc. of water, adding 7.5 cc. of 38 per cent acetic acid, and filtering. To 15 cc. of this solution in a conical flask is added 5 cc. of the solution to be tested, which should contain at the most 0.1 gm. of reducing sugar. The solution is heated to boiling and kept at this temperature for 3 minutes, after which it is immediately filtered, the precipitate dissolved on the filter paper in a solution of ferric sulphate, and the sugar determined in the filtrate according to Bertrand's method by titrating with potassium permanganate of such strength that 1 cc. corresponds to 6 mg. of copper. The amount of reducing sugar in the solution is calculated from a table of the weights of copper obtained in determinations on known amounts of sugar. To calculate the amount of maltose or lactose contained in the solution, results obtained by the Barfoed method are subtracted from the sum of the reducing sugars expressed as glucose determined by Fehling's solution.

Microanalytical methods in oil analysis, A. H. Gill and H. S. Simms (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 547–552, figs. 8*).—Microanalytical methods for the determination of the iodin and saponification numbers and the specific gravity of oils are described, with illustrations of the necessary apparatus. Data on the analysis of lard, olive, cottonseed, and linseed oils by the new method are reported. Very close analytical results in the saponification and iodin values of these oils were obtained with 15 and 11 mg., respectively, or about one one-hundredth and one-thirtieth the usual quantities, while good results were obtained for specific gravity with 1-gm. samples.

Determination of refractive indices of oils, H. S. Simms (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 546, 547, figs. 3*).—The method described depends upon the principle that if a spherical bulb of oil is immersed in a medium of another oil it will magnify or reduce, depending upon whether it has a greater or smaller refractive index than the medium.

Studies in synthetic drug analysis.—VIII, Estimation of salicylates and phenol, W. O. Emery (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 538, 539*).

Approved technique of the Rideal-Walker test, S. RIDEAL and J. T. A. WALKER (*London: H. K. Lewis & Co., Ltd., 1921, pp. 12*).—This is a description of the details of the Rideal-Walker method of testing disinfectants as officially adopted at the present time in Great Britain and the British Colonies.

Condensed description of the manufacture of beet sugar, F. MURKE (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, pp. V+175*).—This is a concise treatment of the main principles of beet sugar manufacture. Useful formulas and tables for various calculations are included.

Make better vinegar, R. L. TWEED (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 24, 25*).—The factors essential for making cider vinegar of good quality are briefly outlined. It is emphasized that the barrels for vinegar making should be thoroughly rinsed and scalded before the cider is added, that pure cultures of yeast and vinegar bacteria produce a higher yield of vinegar of the best quality than can be obtained if the fermentation is left to chance, and that the fermentation is more rapid if the barrels are stored at a temperature of about 75° F. than under cellar conditions.

Effect of heat on different dehydrated vegetables, C. E. MANGELS and H. C. GORE (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 525, 526*).—A brief report is given of an investigation at the Bureau of Chemistry, U. S. Department of Agriculture, of the limits of tolerance to heat of different vegetables and of the importance in causing deterioration of three variables—the degree of temperature used, the time of exposure to such temperature, and the relative humidity of the surrounding medium, air. In the exeriments reported, finely divided vegetables, which had already been dried under conditions precluding deterioration, were exposed to different temperatures in an experimental cabinet in which a constant temperature and varying degrees of humidity could be maintained. The dried vegetables were spread on wire trays, placed in the cabinet, and exposed to the desired condition for definite periods of time, and then compared as to appearance with the original dried material.

Onions, turnips, celery, tomatoes, and cabbage were very easily injured by heat, while white potatoes, carrots, string beans, and sweet corn proved fairly resistant and sweet potatoes very resistant. In general the injury point, as determined by darkening in color, was quite distinct and definite at temperatures of 70° C. and higher, the time of exposure necessary to cause injury decreasing with increasing temperature and with increase in relative humidity. As illustrating the varying degrees of sensitivity of the three groups of vegetables under different conditions, injury took place in onions in dry heat after 12 to 16 hours' exposure at 50°, 6 hours at 55°, and 5 hours at 60°, and in moist heat after 8 to 10 hours at 50° and 4 hours at 60°. At from 70 to 90° dry and moist heat had about the same effect. With white potatoes injury occurred in dry heat after 16 hours' exposure at 50°, 11 hours at 55°, and 8 hours at 60°, while in moist atmosphere injury occurred after 11 hours at 50° and 7 hours at 60°. Sweet potatoes were not apparently injured by temperatures lower than 80°. In a dry atmosphere at 90° injury occurred after 5 hours and at 80° after 10 hours. In moist atmosphere at 90° injury occurred in from 8 to 12 hours, while at 80° no injury occurred after 10 hours.

The relation of moisture content to the deterioration of raw dried vegetables upon common storage, H. C. GORE and C. E. MANGELS (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 523, 524*).—Data are reported from the Bureau of Chemistry, U. S. Department of Agriculture, on the moisture content of various vegetables dried at different temperatures for varying periods of time and stored at ordinary temperatures in air-tight containers, and on the change in appearance of the dried vegetables after periods of storage of from 29 to 940 days.

The moisture content of the dehydrated raw vegetables was found to be a factor of considerable importance for successful storage. The initial moisture content at and below which the distinctive color and flavor are well retained for six months or more are reported as follows: Carrots 4.99 to 7.39 per cent, turnips 5, onions 5.74 to 6.64, spinach 3.81 to 5.38, and cabbage 3 to 3.34 per cent.

Dehydration of fruits (a process report), W. V. CRUESS and A. W. CHRISTIE (*California Sta. Bul. 330 (1921), pp. 49–77, figs. 2*).—This publication gives the results of investigations and observations on the dehydration of the more important varieties of fruits in California, including the effect of various factors on the yield, composition, and quality of the product, and a comparison of dehydrated with sun-dried products. The results reported are summarized in a table in which are listed the tested methods of preparation and conditions of dehydration which are recommended as furnishing the best results, using in all cases the air-blast tunnel type of dehydrator. The list includes the following fruits: Apples, apricots, bananas, cherries, figs, grapes, loganberries, peaches, pears, prunes, raspberries, and strawberries.

The manufacture of citric acid from lemons, C. P. WILSON (*Jour. Indus. and Engin. Chem., 13 (1921), No. 6, pp. 554–558, fig. 1*).—This is a comprehensive description of the successive steps in the manufacture of pure citric acid from cull lemons as developed at the Citrus By-products Laboratory of the U. S. Department of Agriculture at Los Angeles, Calif.

Elephant grass (Pennisetum purpureum): Pulping qualities (*Queensland Agr. Jour., 16 (1921), No. 1, p. 8*).—Tests of the pulping qualities of elephant grass were conducted by the caustic soda process. The material tested was composed of 49 per cent internodes, 29 per cent nodes, and 26 per cent leaves, and the moisture content was 65.4 per cent. Yields based on moisture-free material and pulps were as follows: Unbleached pulp 36 per cent, bleached pulp 30 per cent, and bleaching powder 15 per cent. The fiber length ranged from 4.3 to 0.35 mm., averaging 0.92 mm., and the diameters of fibers averaged 0.016 mm. The unbleached pulp would be far too expensive for wrapping paper, but could probably be used to some extent in covers and colored papers.

METEOROLOGY.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), No. 13, pp. [229], pls. 20, figs. 12*).—This number summarizes the climatological data for each month of 1920 and for the year as a whole for each State.

The weather of Scotland in 1920, A. WATT (*Highland and Agr. Soc. Scot. Trans., 5. ser., 33 (1921), pp. 287–295*).—"This report consists of (1) a general description of the weather over the Scottish area from month to month: (2) a selection of rainfall returns, in which each county in Scotland is represented by one or more stations. . . .

"The outstanding features of 1920 were the mildness of the January–March period, the almost complete absence of seasonable warmth in July and August, the great mildness of November, and the wide range of rainfall conditions relatively to the normal. Toward northeast and north the year was a dry one, while in west and south aggregates were above the normal."

The extent of the recent drought (*Nature [London], 108 (1921), No. 2705, pp. 15–17, fig. 1*).—The amount and distribution of rainfall in the British Isles, from January to June, 1921, is compared with the normal for the same region, showing a pronounced drought in England and Wales but a less severe one in Scotland and Ireland.

Summarizing data for other countries, it is sown that "the drought has been mainly European, chiefly in northwest Europe and Russia. Canada has had extremely hot weather, but without a serious deficiency of rain. The season in Australia has been abnormal, and there are indications of abnormal conditions in other widely separated regions, notably Irak and Peru. The only region of special excess of rain in the Northern Hemisphere appears to have been the southern United States."

"New York suffered from several hot spells in June and July, an unusual feature being the accompaniment of exceptionally high humidity, which intensified their effect. In the latter month the whole of the middle section of the country eastward of the Rockies experienced great heat. There does not seem to have been any general deficiency of rain. Further south the cotton-growing districts had an excess of rainfall in July."

Distribution of rainfall in Italy in relation to agriculture, A. CALZECCHI-ONESTI (*Italia Agr., 58 (1921), No. 2, pp. 51–56, figs. 2*).—This article discusses briefly the importance of rainfall in agricultural production, the variability of meteorological factors in Italy, the value of rainfall stations and the need of more of them, and the total annual precipitation and its frequency and distribution as related to agriculture.

SOILS—FERTILIZERS.

Conservation of soil fertility and soil fiber (*Ottawa: Canada Comn. Conserv., 1920, pp. 89, figs. 4*).—This is a report of a conference held in Winnipeg, Man., on July 14–16, 1920, under the auspices of the Commission of Conservation of Canada. The following papers relating to soil conservation and fertility were presented: Soil Conservation and Western Crop Production, by J. H. Grisdale; The Choice of Crops and Soil Productiveness, by G. H. Cutler; Cropping Systems for Drought Areas, by J. Bracken; Advantages and Profits of Systematic Crop Rotations, by W. C. McKillican; Good Seed, by L. H. Newman; Soil Moisture, by E. S. Hopkins; Maintenance of Soil Fiber, by T. J. Harrison; Fundamental Priciples of Soil Fertility, by R. Hansen; Soil Drifting in Southern Alberta, by W. H. Fairfield; Urgency for Further Irrigation Development in Southern Alberta, by G. R. Marnoch; Influence of Windbreaks on Field Crops, by N. M. Ross; and The Weed Menace and Its Control, by S. A. Bedford.

The formation of humus, V. A. BECKLEY (*Jour. Agr. Sci. [England], 11 (1921), No. 1, pp. 69–77*).—Studies conducted at the Rothamsted Experimental Station are reported, in which evidence is adduced that the formation of humus, both in the laboratory and soil, proceeds in two stages as follows: Carbohydrates react with either mineral or amino acids to produce hydroxymethylfurfural; hydroxymethyl-furfural condenses to form humus. It was found in addition that in the laboratory some furfural and laevulinic acid are also produced. No evidence could be obtained of the formation of hydroxymethylfurfural during the decomposition of cellulose by *Spirochaeta cytophaga*.

Nitrate formation in soil, C. BARTHEL (*Svensk Kem. Tidskr., 32 (1920), No. 11, pp. 173–183; abs. in Chem. Abs., 15 (1921), No. 7, p. 1053*).—A comprehensive discussion of nitrification in soils is presented in this paper, data from the results of Swedish experiments especially being summarized.

It is pointed out that nitrate is formed in acid, alkaline, and neutral soils, either clay or loam, and that nitrification proceeds better in the presence of organic nitrogen compounds than with ammonium sulphate owing to the inhibiting action of the acidity produced by the decomposition of the ammonium sulphate. The addition of lime is considered to be of distinct benefit where

ammonium sulphate is used, but of no advantage in the case of animal manures. It has not been established whether or not the organisms responsible for nitrification in acid soils are the same as those in alkaline or neutral soils.

Influence of uranium salts on nitrogen fixation, E. KAYSER (*Compt. Rend Acad. Sci. [Paris], 172 (1921), No. 18, pp. 1133, 1134*).—Studies of the influence of uranium phosphate and acetate on the growth and activity of *Azotobacter agile* in mannite and glucose cultures showed that both uranium compounds increased the fixation of nitrogen by these organisms. The greater fixation took place where the acetate was used. It is considered probable that the radioactive power of uranium is a dominant factor in contributing to the stimulation of nitrogen fixation by soil organisms.

Researches on Azotobacter, KAYSER (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 15, pp. 939, 940*).—A study on the influence of color on the action of Azotobacter at different stages of its culture and on the influence of temperature in varying the results is reported.

It was found that at 27° C. the generations from yellow and blue growths gave practically the same results as regards total nitrogen fixation and the nitrogen fixed per gram of mannite consumed. The utilization of mannite became less satisfactory as the time of incubation was increased. It was more satisfactory at a temperature of from 8 to 16° than at 27°, although the total nitrogen fixed at the lower temperature was much less.

A bacteriological analysis and cultural test of "nitrobacter soil vaccine," D. H. JONES (*Sci. Agr., 1 (1921), No. 6, pp. 266, 267*).—Studies conducted at the Ontario Agricultural College on the biological composition and activities of a so-called soil vaccine, purported to increase the availability of nitrogen and phosphorus in the soil, are reported.

The vaccine did not increase the denitrifying, ammonifying, nitrifying, or nitrogen-fixing bacterial content of the soil. Progress results of cropping tests comparing soil vaccine with stable manure were decidedly in favor of the manure.

Nitrogen losses under intensive cropping, J. G. LIPMAN and A. W. BLAIR (*Soil Sci., 12 (1921), No. 1, pp. 1–19, figs. 6*).—Studies conducted at the New Jersey Experiment Stations on the nitrogen losses from a loam soil in cylinders with natural drainage, which has been under a 5-year rotation of corn, oats, wheat, and timothy for 20 years, are reported.

There are 60 of these cylinders arranged in 20 series of 3 cylinders each, and the fertilizer and manure treatment is the same for the 3 cylinders of a given series. Different forms of nitrogenous fertilizers have been used, alone and in combination with farm manure. All cylinders with the exception of the first series have received liberal applications of phosphoric acid and potash annually. During the first 10 years the lime treatment was the same for all cylinders. Beginning with the second 10-year period, lime (ground limestone) was applied to the second and third year cylinders of each series at 5-year intervals. A further differentiation was brought about by growing two legume green-manure crops on the third cylinder of each series in the course of each 5-year rotation. Thus the first cylinder of each series, or 20 cylinders designated as section A, were without lime for 20 years.

A complete record was kept of the amount of nitrogen applied in the form of fertilizers or manures and of the amount removed by the crops during this period. Also, nitrogen determinations were made on samples of the original soil and on samples collected in 1907, 1912, and 1918. From these latter records, the loss of nitrogen from the soil, exclusive of that removed by the crops, was calculated. During the first 10 years this amounted to 32.24 gm. per

cylinder, or the equivalent of 103 lbs. per acre annually. During the third 5-year period the loss was one-half this amount, except in the legume section, or again 103 lbs. per acre annually. During the fourth 5-year period the average loss was considerably less, and for certain of the cylinders on sections A and C there was some gain. This gain on section C is attributed largely to the legume crops grown, but there appeared to be no particular reason for the gain on three of the cylinders of section A. This statement of gain, however, is not considered a contradiction of the statement that in most cases these soils have been constantly losing in nitrogen content, since with only one or two exceptions more nitrogen was applied than was removed by the crops.

Carbon determinations made on the set of samples collected in 1918 showed gains in carbon content over the original soil for nearly all those cylinders that received both farm manure and commercial nitrogenous fertilizers. Those soils that received farm manure alone did not change much in carbon content, while those that received nitrogen in the form of commercial fertilizers only or no nitrogen at all lost appreciably in carbon content. A gain in carbon is not considered to be necessarily inconsistent with a loss in nitrogen.

A preliminary investigation into the occurrence of different kinds of carbonates in certain soils, F. HARDY (*Jour. Agr. Sci.* [*England*], *11* (*1921*), *No. 1, pp. 1–18*).—Mineralogical, biological, and chemical studies of samples of soils taken from the foreshore of the northwest coastal belt of the Wash in England are reported.

A sample of marine silt taken from the locality was found by mineralogical examination to contain dolomite. Nitrification experiments and detailed chemical studies into the nature of the carbonate content of several soils of known geological and agricultural history indicated that the presence of dolomite in the marine silt modifies such processes as nitrification. A method for the approximate estimation of easily decomposed calcitoid carbonate and of more stable dolomitoid carbonate in soils was elaborated and applied in the chemical investigation.

It was found that marine silt soils may be expected to contain both calcitoid and dolomitoid carbonate. Soils not directly or indirectly derived from marine silts usually did not contain dolomitoid carbonate, although they sometimes contained calcitoid carbonate. Cultivation for crop production reduced both the calcitoid and the dolomitoid carbonate content of soils containing both, but the rate of reduction of the former was considerably greater than that of the latter.

It is concluded that sourness in soils originally containing both kinds of carbonate may occur when the total carbonate content is apparently well above the usual value taken by soil chemists as indicating a deficiency of carbonate. This is explained by the relatively greater stability of dolomitoid carbonate toward weak acids such as are supposed to accumulate in many cases of soil acidity. It is further concluded that marine silt soils and soils derived therefrom should receive special consideration from the soil chemist when problems relating to their carbonate content are under investigation.

The nature of soil acidity with regard to its quantitative determination, W. H. MACINTIRE (*Jour. Amer. Soc. Agron., 13* (*1921*), *No. 4, pp. 137–161*).—In a contribution from the Tennessee Experiment Station a summary and analysis of viewpoints and hypotheses advanced as to the nature of soil acidity are presented.

The opinion is expressed that the acidity of mucks and peats poor in alkali and alkali earth bases can not be considered on the same basis as rock-derived soils. With reference to the latter soils it is pointed out that "although salts

of a number of organic acids have been isolated from soils, no one definite free organic acid has ever been extracted, as of record. If all of the organic carbon in many soils was considered as being a constituent of a definite organic acid, the hypothetical acid so calculated would be equivalent to only a fraction of the amount of acidity determined by different methods of procedure. . . .

"Removal, or adsorption, of dissolved bases by soils appears to be a chemical function of acid silicates, principally alumino-silicates, the extent of whose hydration is a controlling factor in initial intensity and continuity of reaction. The acidity of soils is, in the main, induced by the loss of calcic and magnesic inorganic salts, derived originally from the hydrolysis of the alkali-earth siliceous complexes, thereby increasing the acid properties or amount of acid silicates. . . . Silicic acid in mass will progressively hydrolyze and continue to decompose calcium and magnesium carbonate when the liberated CO_2 is removed from solution. This acid will pass from the solid to solution phase, yielding H-ion concentration, and is capable of effecting an inversion of cane sugar.

"After intense alkali treatments and the removal of excess of hydrates and after intense heating, pure silicates, and titanium oxid will, on the addition of H_2O, hydrolyze and act as acids toward the alkali-earth bases. Many acid soils will yield aqueous extracts, alkaline to some of the common indicators, but showing H-ion concentration by electrometric or colorimetric methods. The H-ion concentrations of acid soils are not generally considered as being of such intensity as to be of direct detriment to higher plant life, though they may affect the growth of bacteria and fungi.

"The injurious effect of acidity may be attributed in some instances to aluminum and other toxic salts, but, in general, more particularly to the diminished supply of available calcium from the depleted lime content of the soil, as influencing the adaptability of the media for biological development and the meagerness of the lime as plant food, or as an essential regulatory component of the plant juice. The formation of organic acids and the generation of mineral acids, such as nitric, in soils may be conceded; but their occurrence within the soil seems to be of but brief duration, because of neutralization by native or applied basic materials.

"The reactions between soils and alkali-earth carbonates are characterized by a more intense initial activity, with a continued and lesser intensity extending over a long period of time. Such variations have been attributed to different acids, of active and less active 'avidity', or to the greater immediate solubility and the lesser progressive solubility of silicic acid and its acid salts. An excess of basic carbonates may occur in a soil possessing slow-reacting, but potential, acidity in the form of slowly hydrolyzing and ionizing silicic acids and their acid hydrogen salts. And finally, though not unanimously agreed, it seems to be the majority viewpoint that the laboratory determination of a soil's tendency to absorb, fix, or neutralize lime is an academic consideration, without any definitely established quantitative correlation with field practice."

An extensive bibliography is appended.

Residual effects of carbon-dioxid gas additions to soil on roots of Lactuca sativa, H. A. Noyes and J. H. Weghorst (*Bot. Gaz., 69 (1920), No. 4, pp. 332–336, figs. 5*).—Experiments conducted at the Indiana Experiment Station, in which *Capsicum annuum abreviatum, L. sativa, Raphanus sativus,* and *Phaseolus vulgaris* were grown in soil to which carbon-dioxid gas was added subterraneously, are reported.

The last three species were grown in the same soil with fertilizer and manure treatments. The objects of the experiments were to determine the residual effect of carbon-dioxid treatment on the availability of plant nutrients in the soil, and to determine if more mineral plant nutrients were made available by

carbon-dioxid treatment on a soil deficient in nitrogen but which was treated with nitrogen in available form.

The roots of plants grown in pots that had received carbon-dioxid gas the previous year showed malformations. Where no gas treatment was given the roots were well spread and extended considerably into the soil. The results are taken to indicate that "something was left in the soil, due to carbon-dioxid gas additions to the soil the previous year, which both shortened the tap roots and the distance below the crown at which the roots curved or split up into smaller roots. The residual effects of the gas were greater for the continuous than the intermittent treatments. The roots of the plants where the 24-hour treatments of carbon dioxid has been given were more affected under the manure than the fertilizer treatments." With no gas treatment the roots of plants grown in manure tended to resemble those in which carbon-dioxid gas was applied to the soil.

These results are thought to confirm the belief that the carbon-dioxid content of garden soils is sometimes detrimental to the root development of some plants.

A contribution to the investigation into the results of partial sterilization of the soil by heat, ELVEDEN (*Jour. Agr. Sci.* [*England*], *11* (*1921*), *No. 2, pp. 197–209, figs. 9*).—Experiments with recently made kitchen garden soil and near-by field soil are reported.

It was attempted to ascertain whether the effect of heating would prove of greater benefit to the soil at any particular level, and whether this optimum depth would show variation depending on the season of the year. Where steam heat was used, no noticeable effect was observed which would indicate that enemies to plant growth, capable of being destroyed by partial sterilization, congregate at a certain depth of the soil or move up and down according to the season of the year.

There was some indication that where the soil is capable of yielding a fair crop, the percentage of increase obtained by steaming will be greater than where the soil is deficient in plant nutrients. The richer garden soil, when steamed, gave on the whole greater increases than the field soil, while in the latter little reaction was ever obtained below 12 in. where soil not previously disturbed was reached.

The level at which the maximum increase was obtained varied considerably in each experiment, being by no means confined to the layers near the surface. While in the garden soil the maximum increase obtained varied from the surface layer to that from 16 to 18 in. below the surface in the field soil, the maximum was always obtained in the top 10 in. and rarely below 8 in. It also appeared that the benefit obtained by steaming is not confined to the first crop.

In experiments on partial sterilization of soil by dry heat, satisfactory results were obtained with soil which had been passed through a naked flame and raised to an approximate temperature of from 80 to 90° C. On the whole these results were not as good as those given by steamed soil, the temperature being lower and the soil uniformly heated. Soil heated by electricity also gave good results, provided a sufficient temperature was reached. It appeared probable from these studies that the maximum increase of crop to be obtained by steaming the soil will occur in previously manured soil at those depths where the manuring has been most thorough, and that the effect of partial sterilization is to liberate some plant food present but not always available.

Dephenolization in soil, N. N. SEN-GUPTA (*Jour. Agr. Sci.* [*England*], *11* (*1921*), *No. 2, pp. 136–158, figs. 6*).—Studies conducted at the Rothamsted Experimental Station to determine the causes for the disappearance of phenol and the cresols from soils are reported, in which two colorimetric methods of

estimation of these materials in soil were developed, one for small quantities and the other for larger quantities.

It was found that even when starting the distillation of the soil within 20 minutes after the application of the phenol, a 100 per cent recovery of the added phenol can not be effected except in the case of autoclaved or steamed soil. This instantaneous disappearance was followed by a further loss slower and different in character. Phenol and the three cresols disappeared with more or less ease in all soils examined. The slow disappearance was apparently largely brought about by microorganisms which are capable of decomposing phenol. There appeared, however, to be some nonbiological action also, since the disappearance in unmanured soil poor in microorganisms, besides being much slower than in manured soil, was altogether different in character.

Partial sterilization by treatment with toluene which was evaporated before the addition of phenol increased the rate of loss, but steaming did not. The disappearance took place even in soil air dried to 2.4 per cent moisture, but was extremely slow compared with the rate in normal soil. By applying a number of successive doses of phenol to the same soil it was found that each dose disappeared at a higher rate than the preceding one. This is entirely in accordance with an action mainly biological in character. The same effect was observed in the case of *m*-cresol.

Two types of bacteria were isolated from soil which are able to decompose phenol in culture solutions containing mineral salts and phenol. A third type capable of decomposing *m*-cresol was also isolated from soil.

The instantaneous disappearance of phenol occurred in all soils examined. Its cause appeared to be nonbiological, but its exact nature has not yet been elucidated. There is reason to believe that the loss varies with the clay content of the soil. It did not appear to be materially affected by the period of contact of phenol with the soil prior to distillation, and was presumably complete only when the soil (air-dry) had been uniformly moistened with steam. Up to a certain point the loss was proportional to the concentration of the phenol solution. The factor causing the loss was destroyed by autoclaving the soil at 130° C. for half an hour or by steaming at 100° for one hour. Treatment of the soil with sulphuric acid (50 per cent by volume) either before or after addition of phenol greatly augmented the loss, which may amount to 90 per cent in case of phenol and 96 per cent in case of *m*-cresol. This loss was not affected by autoclaving the soil.

Thus there appeared to be at least three processes whereby phenol disappears from soil—one biological, one instantaneous chemical or physical, and a third slow chemical or physical. The mechanism of these changes, however, has not been elucidated.

The occurrence of substances injurious to crops in certain volcanic ash deposits, J. T. White (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Agrogeol. en Grondonderz., No. 6 (1920), pp. 11; also in Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 44, pp. 1891–1901; abs. in Chem. Abs., 15 (1921), No. 4, p. 568*).—Analytical studies of the different layers of volcanic ash deposited during a volcano eruption in Java in 1920 are reported.

It was found that several of the samples contained less than 1 per cent of material soluble in distilled water, and that the finely divided ashes yielded more than the coarser ones. No injurious constituents were detected in the water extracts, and corn plants grew normally in them. That part of the ashes which was insoluble in water was found to consist of volcanic glass, pyroxene, amphibole, plagioclase, and ore. The samples from all but two localities contained no injurious substances. A blue and a brown layer were detected in these two samples, which contained pyrites and pyrrhotite. The weathering of these two

materials resulted in the production of sulphuric acid and, under certain conditions, hydrogen sulphid.

It is concluded that where ashes of this nature have been deposited the soil should be worked to produce rapid oxidation and well drained to permit removal of the oxidation products. Liming is also recommended.

Kalar reclamation as carried out on the Sukkur farm, L. L. RELWANI (*Poona Agr. Col. Mag., 12 (1921), No. 3, pp. 117–123*).—Experiments on the reclamation of kalar or alkali soil are reported and discussed. It is concluded that the most rapid and effective method of reclaiming kalar, where pumped water is used for irrigation, is to construct a drain on the lower side of the plat only and grow *Panicum stagninum* on the land for one or two seasons. The land should then be plowed up and planted with clover and the soil steadily enriched with farmyard manure.

Soil drifting, W. A. MUNRO (*Canada Expt. Farms Rpt. 1920, pp. 160, 161*).—A brief study at Rosthern, Sask., led to the conclusion that heavy applications of manure once in from four to six years tend to prevent soil drifting, and that seeding to grass once in six years and leaving in sod two years effectively prevents it. It was also found that a stand of trees protects the land in the direction toward which the wind is blowing for a distance of 50 ft. for every foot in height of the clump of trees.

Investigational work with fertilizers, F. T. SHUTT (*Canada Expt. Farms Rpt. 1920, pp. 45–49*).—A continuation of work previously noted (E. S. R., 43, p. 726), to determine the most profitable combination and quantity of fertilizer mixture throughout a 3-year rotation, consisting of a hoed crop, grain, and hay, showed that on poor soils an application of sodium nitrate to grain at seeding time is a profitable practice. It was also found that a complete fertilizer will give a larger and more remunerative yield on most of the cultivated soils which are not in a high state of fertility than a fertilizer containing any single element of plant food. The importance of maintaining organic matter content in soils and the use of lime are also indicated.

An experiment to determine the relative values of nitrogen, phosphoric acid, and potash, as furnished by several commercial fertilizers, showed that the maximum yield in the nitrogen group was attained from a plat receiving sodium nitrate and dried blood with superphosphate and potassium chlorid. In the phosphoric acid group the maximum yield was obtained from basic slag used with sodium nitrate and potassium chlorid. In the potash group the maximum yield was obtained from the plat receiving Nebraska potassium sulphate used with sodium nitrate and superphosphate.

Analyses of 23 samples of limestones, 19 samples of air-dried marls, 3 samples of lime, and 7 samples of tobacco factory wastes are also included.

Fertilizing experiment, R. G. NEWTON (*Canada Expt. Farms Rpt. 1920, pp. 182, 183*).—The first year's results of an experiment to ascertain the effect of omitting in turn each element of plant food from a fertilizer mixture on a 3-year rotation of potatoes, oats, and clover are presented, no conclusions being drawn.

Fertilizers and fertilizer mixtures for different crops commonly grown in North Carolina, C. B. WILLIAMS (*N. C. Dept. Agr. Bul., 1921, May, pp. 2–13*).—Practical information on fertilizers and fertilizer mixtures adapted for different crops commonly grown on the Coastal Plain and mountain soils of North Carolina is presented.

Fertilizing soils for grains and seedings, M. M. MCCOOL, G. M. GRANTHAM, and C. W. SIMPSON (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 3–5, fig. 1*).—Brief popular information on the fertilization of soils for fall grains and for

seedings is presented, including the results of tests being conducted cooperatively with farmers and county agents.

Manuring of vegetables, M. Tewfik Hefnawi (*Egypt Min. Agr., Hort. Sect. Leaflet 15 (1920), pp. [2]+13*).—Egyptian practice in the manuring of vegetables is discussed in this leaflet. With reference to nitrogenous manures, certain types peculiar to Egypt are discussed.

Kufri is a nitrogenous fertilizer taken from the mounds which form the remains of ancient villages. It contains usually from 1 to 2 per cent of nitrate and also considerable sodium chlorid. Tafla is another local nitrogenous fertilizer, consisting of sodium nitrate mixed with clay and limestone. The nitrate content varies from 1 to 16 per cent. Among the organic manures used, street sweepings and poudrette are considered relatively important. Practical hints as to mixtures and proportions of fertilizers for different crops are included.

High analysis fertilizers, F. E. Bear (*Ohio State Univ., Timely Soil Topics, No. 38 (1921), pp. [4]*).—Popular information on the use of high-grade fertilizers in Ohio, indicating their advantage over low-grade fertilizers, especially as regards first cost, is given.

Some observations on crude night soil as manure to cotton in East Khandesh, B. P. Vagholkar (*Poona Agr. Col. Mag., 12 (1921), No. 3, pp. 113–116*).—Rather general data on the experimental use of crude night soil as a fertilizer for cotton on the experiment farm at Jalgaon are reported.

Requirements of meadow soils for nitrogen fertilization, P. Bolin (*Meddel. Centralanst., Försöksv. Jordbruksområdet, No. 207 (1920), pp. 16; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 6, pp. 401–414*).—Six years' studies of the influence of nitrogen fertilization on both mineral and organic meadow soils are reported.

Sodium nitrate was applied alone at the rate of 100 kg. per hectare (89 lbs. per acre) and mixed with phosphate and potash fertilizers at rates of 100 and 200 kg. per hectare. Sodium nitrate alone gave about as good results on mineral meadow soils as a medium fertilization with phosphate and potash except on clover. When mixed with phosphate and potash in the smaller amount, about the same crop increases were obtained as when sodium nitrate was used alone and when phosphate and potash were used alone. A mixture of 200 kg. of sodium nitrate with phosphate and potash fertilizers increased the crop not quite twice as much as a mixture of 100 kg. of sodium nitrate with phosphate and potash.

Sodium nitrate gave the best results on grass meadow, medium results on mixed grass and clover, and the poorest results on clover. The older the meadow the greater was the action of sodium nitrate, especially where the percentage of grass was on the increase. Sodium nitrate had a marked influence in increasing the crop of grass even on muck soils. The mixture of 100 kg. of sodium nitrate with phosphate and potash had only a slight residual effect on both mineral and organic soils, while phosphate and potash applied alone had a marked residual effect on these soils, especially on the latter.

Mineral resources of the United States in 1920, compiled by M. B. Clark (*U. S. Geol. Survey, Prelim. Summary Min. Resources U. S., 1920, pp. 123, fig. 1*).—This report is the third annual preliminary summary of the mineral production of the country, and contains sections on potash, phosphate rock, peat, marl, and lime.

Fertilizing value of [fossil] phosphorite rock on peat soils, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 35 (1921) No. 2, pp. 136–143*).—Two years' experiments with clover on acid peat soil showed that phosphorite

rock, occurring as fossil lime formations in certain quarries, had no noteworthy fertilizing action during a period of this length owing to its apparent insolubility.

Results of phos-pho-germ experiments conducted during 1919–1920, W. F. PATE (*N. C. Dept. Agr. Bul., 1921, May, pp. 14–16, fig. 1*).—Analyses of samples of phos-pho-germ are presented showing that the material consists mainly of finely ground rock phosphate and dried organic matter.

Experiments on rye, corn, and cotton to compare phos-pho-germ with complete commercial fertilizers showed that with rye and corn the yield was not increased by phos-pho-germ, while a considerable increase was obtained with a complete fertilizer. A small increase was obtained with cotton by the use of phos-pho-germ, while a complete fertilizer gave a marked increase.

The purchase and use of phos-pho-germ in place of commercial fertilizers is not recommended for the farmers of North Carolina.

Liming with high-magnesium v. high-calcium limes, B. L. HARTWELL (*Rhode Island Sta. Bul. 186 (1921), pp. 3–19*).—Studies on the liming effects of high-calcium and high-magnesium limestones and of the burnt and hydrated products of these materials when used on Miami silt loam soil are reported. No farm manures were used, but fertilizer chemicals were usually applied so liberally that the liming materials were expected to act only as neutralizers of acid and not as sources of any required plant nutrients.

In the twelfth year of the experiment the ratio of magnesium oxid to calcium oxid extracted from the soil by carbonated water was about 1:7 from the plats receiving the calcic limes, 1:1.7 from those receiving the magnesic limes, and 1:2.2 from the unlimed plat. Yields were equally satisfactory whether the ration was 1:7 or 1:1.7. In the ninth year the ratio of magnesium oxid to calcium oxid in dried endive was 1:1.1 and 1:1.5 with magnesic hydrate and limestone, respectively, whereas it was 1:2.2, 1:3, and 1:2.8 with calcic hydrate, limestone, and no lime, respectively.

Determinations of the humus content and loss on ignition indicated slightly less organic matter in the soil to which the hydrates had been added than where limestone was used. It is considered uncertain that the use of the different limes has been accompanied by a change in the nitrogen content of the limed soil as compared with that of the unlimed soil, although the percentage of nitrogen was slightly higher where magnesic limestone was used. The unlimed plat was decidedly acid as compared with the limed plats, and it was the only one from which aluminum could be extracted by certain normal salt solutions and by carbonated water. Certain sensitive crops were much benefited by the liming. The beet crop, for example, was frequently increased sixfold. Even such sensitive crops, however, did not react to the liming sufficiently to warrant generalizations as to the specific effects of the different kinds of lime.

These results are taken to indicate that similar effects may be expected generally, regardless of which of the four forms of lime is used, from an application having a given neutralizing equivalent. This is true provided the limestones are sufficiently fine to pass through an 80-mesh sieve and the hydrates are used with the ordinary precautions.

Fertilizer and limestone experiments, W. S. BLAIR (*Canada Expt. Farms Rpt. 1920, pp. 99, 100*).—Experiments at Kentville, N. S., with potatoes, oats, and hay to determine the influence of fertilizers and lime showed that liming increased all three crops whether unfertilized, manured and fertilized, or manured and not fertilized.

Reading list on lime, compiled by C. J. WEST (*Spec. Libraries, 12 (1921), No. 4, pp. 71–87*).—An extensive list of references to articles and reports

relating to the production and use of lime, especially in engineering and agriculture, is given.

Chlorin content of soils and fertilizer test of salt, L. C. HARLOW (*Nova Scotia Sec. Agr. Ann. Rpt., 1920, pt. 1, pp. 117–122*).—Determinations of the chlorin content of a number of samples of inland and seashore soils from Nova Scotia showed that this content ranged from 48 to 6,900 lbs., per acre-foot.

Fertilizer tests with material containing over 80 per cent of sodium chlorid led to the conclusion that, since the amount of potash used was very small, the variations in the crops were probably due to the sodium chlorid. It is considered possible that further investigation may lead to the development of practical rules for the use of chlorids as fertilizers.

The fertilizing value of rain and snow, F. T. SHUTT (*Canada Expt. Farms Rpt. 1920, pp. 54, 55*).—Results of examinations of 79 samples of rain and 24 of snow, collected at Ottawa during the year ended February 29, 1920, are summarized showing that with a total precipitation of 33.23 in., 23.39 in. rain and 98.5 in. snow, the total nitrogen furnished by the precipitation was 7.117 lbs. per acre, 5.909 lbs. in the rain and 1.208 in the snow. The average for the 10 years ended February 28, 1917, were total precipitation 33.17 in., yielding 5.482 lbs. of nitrogen per acre in rain and 1.101 lbs. in snow.

The composition and utilization of exhausted molasses in Mauritius, H. A. TEMPANY and C. D. D'AVOINE (*Mauritius Dept. Agr., Gen. Ser., Bul. 21 (1921), [Eng. ed.], pp. 15*).—Data on the production, chemical composition, and possible uses as sources of fuel and fertilizer of the waste molasses of Mauritius are presented.

A conservative estimate places the average annual production of exhausted molasses on the island at approximately 41,000,000 liters (10,832,200 gal.). It is estimated from the analytical data that the volume yield of absolute alcohol should average 43.5 per cent of the molasses fermented.

Attention is drawn to the possibility of substituting vinasse for molasses as a fertilizer. It is shown that molasses is a valuable fertilizer on the island, but the data indicate that satisfactory results may also be obtained from the use of vinasse. The main difficulty in its employment as a fertilizing material consists in the bulk of liquid to be handled.

Fertilizer analyses, A. J. PATTEN ET AL. (*Michigan Sta. Bul. 291 (1921), pp. 109*).—This bulletin contains the results of actual and guarantied analyses of 907 samples of fertilizers and fertilizer materials, representing 355 brands, collected for inspection in Michigan during the year 1920, and 609 samples collected during the spring season of 1921. The analyses indicate that 255 samples were below the guaranty in one or more ingredients in 1920 and 158 samples in 1921.

Fertilizers, R. VILÁ MAYO (*Porto Rico Dept. Agr. and Labor Sta. Bul. 26 (1920), Spanish ed., pp. 3–39*).—This bulletin reports the inspection, registration, and analyses of fertilizers during the fiscal year 1919–20 at Porto Rico, and includes the text of the Porto Rico fertilizer law, together with the results of actual and guarantied analyses of 172 samples of fertilizers and fertilizer materials collected for inspection in Porto Rico during the period. It is noted that 30 deficiencies were encountered, of which 19 were in ammonia, 4 in phosphoric acid, and 7 in potash.

Fertilizer control, J. L. HILLS, C. H. JONES, ET AL. (*Vermont Sta. Bul. 220 (1921), pp. 3–15*).—This section of this bulletin presents the results of actual and guarantied analyses of 246 samples of fertilizers and fertilizer materials, representing 126 brands, collected for inspection in Vermont during the year 1920. The results of the analyses are taken to indicate that the fertilizers sold during the year, as a whole, were as good as they were reported to be.

AGRICULTURAL BOTANY.

Biochemistry of plants, F. Czapek (*Biochemie der Pflanzen. Jena: Gustav Fischer, 1920, vol. 2, 2. rev. ed., pp. XII+541; 1921, vol. 3, 2. rev. ed., pp. IX+852*).—These two volumes continue the general plan previously exemplified (E. S. R., 30, p. 310). The special biochemistry of plants is continued in accounts of metabolism in connection with proteids, mineral materials, respiration, nitrogenous materials, and nonnitrogenous cyclic carbon compounds.

Some remarks on the methods formulated in a recent article on the quantitative analysis of plant growth, R. A. Fisher (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 367–372*).—This discussion of the first part of the series by Briggs, Kidd, and West, previously noted (E. S. R., 45, p. 525), criticizes the methods and claims therein set forth, holding that the correct measure for the mean value of the relative growth rate during any period is that advocated by Blackman (E. S. R., 43, p. 29) under the name of the efficiency index.

Methods in the quantitative analysis of plant growth, a reply to criticism, G. E. Briggs, F. Kidd, and C. West (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 403–406*).—A reply to the above.

Growth of trees, D. T. MacDougal (*Abs. in Science, n. ser., 54 (1921), No. 1397, p. 338*).—The extended use of a newly designed dendrograph is said to show that the period during which growth takes place even in equable climates with indeterminate seasons does not extend over more than two or three months, and that growth is not rhythmical in any sense, but depends upon food supply, temperature, moisture, and other environmental conditions. The awakening of buds, formation of leaves and flowers, and elongation of branches may occur, it is said, many days or even weeks before trunks begin to enlarge. Variations in growth are reported in which it appears that a tree may be actually smaller in midafternoon than at sunrise. The greatest differences were observed in the ash, pine, spruce, fir, and walnut trees, and the least in poplars, sycamore, beech, and oak trees. Accurate measurements of the changes in trunks internal to the growing layer shows that these variations are directly connected with the mechanism of the ascent of sap, and are explainable upon the assumption of a rigid water column in a trunk composed of wood cells and vessels capable of some shrinkage and expansion.

Eccentric growth and the formation of redwood in the main stem of conifers, G. P. Burns (*Vermont Sta. Bul. 219 (1920), pp. 3–16, pls. 4, figs. 10*).—A study was made of some of the factors which have been held to cause the production of eccentric growth and the formation of redwood in coniferous trees, particular attention being paid to mechanical stimulus, illumination, differences in branching, and gravity. Most of the experiments were conducted to determine the effect of gravity and wind as causal factors in the production of redwood.

Summarizing his results, the author states that redwood and eccentric growth usually but not necessarily occur together. Compression does not act as a stimulus causing the production of redwood, but pressure may be a factor in the differentiation of the annual ring into spring and summer wood. The production of redwood in trees examined in the experiments appeared to be a morphogenic response to gravitation stimulus.

The components and colloidal behavior of plant protoplasm, D. T. MacDougal and H. A. Spoehr (*Amer. Phil. Soc. Proc., 59 (1920), No. 3, pp. 150–170*).—Starting with a summary of generalizations previously noted (E. S. R., 43, p. 429), the authors present certain conclusions founded on newly obtained results. An account of hydration tests of various biocolloids and tabulations of

results, with a discussion of the maximum effects produced by renewing solutions and of the structure and heterotropic swelling of colloidal mixtures, is included.

The action of bases and salts in biocolloids and cell masses, D. T. MacDougal (*Abs. in Science, n. ser., 54 (1921), No. 1397, pp. 337, 338*).—The author claims that strong metallic bases—potassium, sodium, and calcium—exert a limiting effect in concentrations of 0.01M on agar when applied as hydroxids or chlorids. This action, however, is reversed when solutions diluted to 0.001M or 0.0001M are used. A similar accelerating action was observed for hydrochloric acid at 0.0001 normal.

No connection could be established between the hydrogen-ion concentration and swelling, as agar is said to show exaggerated swelling at pH values from 4.2 to 11. Effects as of balanced solutions were obtained with agar, and suggestions of similar action with agar-gelatin-salt mixtures were observed. The incorporation of nutrient salts in agar and biocolloids in proportions such as might occur in plants was found to increase the swelling capacity of some mixtures. Roots of various plants showed special effects in swelling, and also variations according to the ecological type of these organs. The author's investigations are claimed to confirm previous observations that all substances known to facilitate growth of plants accelerate hydration of growing tissues, and of biocolloids simulating their protoplasm when used in low concentrations equivalent to those usually found in living matter.

A cryoscopic method for the estimation of sucrose, H. H. Dixon and T. G. Mason (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1920), No. 1, pp. 8*).—This investigation was undertaken to work out the details of the thermoelectric method of cryoscopy, which, it is claimed, can be used with small quantities of liquid and promises to furnish a rapid and sufficiently accurate means of estimating the sucrose content of physiological fluids. Modifications of the methods are noted, and the results of tests are tabulated with discussion.

A consideration of importance in favor of the cryoscopic method is the absence of any preliminary treatment for the purpose of clearing the sap of such substances as gums. The method, however, was elaborated for work in relation to the osmotic pressure in plants, to which it is said to be specially applicable.

The influence of some organic substances on the development of plants, IV, G. Clamician and C. Ravenna (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29 (1920), I, No. 1–2, pp. 7–13*).—The effects are detailed with discussion of a number of organic compounds on plants, this being a continuation of work previously noted (E. S. R., 43, p. 822).

The influence of some organic substances on plants, V, G. Ciamician and C. Ravenna (*Atti R. Accad. Naz. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 30 (1921), I, No. 1, pp. 3–7*).—This reviews and continues in descriptive and tabular detail, with discussion, accounts above noted.

[Localization of] nicotin in tobacco, B. Luigi (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29 (1920), I, No. 1–2, pp. 62–66*).—Tabulations and discussions are given regarding the percentages of nicotin found in the different parts of the tobacco plant, the relation of nicotin to light, the utilization of nicotin as a reserve, and the influence of nicotin and other compounds on the germination of tobacco seed.

On the inhibition of invertase in the sap of Galanthus nivalis, T. G. Mason (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1920), No. 7, pp. 83–97, figs. 6*).—Experiments were carried out with material from snowdrop (*G. nivalis*), the saps for the freezing point determinations being pressed from tissues rendered permeable by exposure to intense cold, in order to investigate the nature of certain factors tending to limit the activity of invertase.

The data, which are presented in graphic and tabular form, are thought to support the view that factors inhibiting the enzym which hydrolyzes sucrose may be present in the sap. It is suggested that the enzym may be inactivated by adsorption on the coagulated colloids. Discussion is given of the observed facts and modifying factors.

Decomposition of cellulose by aerobic bacteria, J. Groenewege (*Bul. Jard. Bot. Buitenzorg, 3. ser., 2 (1920), No. 3, pp. 261–314*).—This is a partial report in tabular and other detail, of studies on denitrification, culture studies of the organism used, evidences that the denitrification of cellulose is a symbiotic process, and descriptions of the groups of bacteria causing denitrification of cellulose, which process is regarded as a special case of aerobic decomposition.

Photosynthesis and the electronic theory, H. H. Dixon and H. H. Poole (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1920), No. 5, pp. 63–77, figs. 2*).—Experiments are outlined which are claimed to show that those light wave-lengths which are effective in photosynthesis are practically incapable of expelling electrons from the leaf-pigment complex, and hence can not in this way produce ionization or bring about reactions external to the pigment. The action is thought to occur within the molecule of the chlorophyll itself, electrons being transferred possibly from one atom to another, thus altering the linkage, and hence the chemical nature of the molecule.

For the present, it appears one must assume that the atomic groups of the leaf pigment enter into the reaction of photosynthesis, and participate in the combinations and decompositions which ultimately lead to the formation of carbohydrates and the evolution of oxygen.

The excretion of toxins from the roots of plants, J. N. Mukerji (*Agr. Jour. India, 15 (1920), No. 5, pp. 502–507, fig. 1*).—Studies with gram, wheat, and Cajanus are thought to indicate that these crop plants do not excrete substances which are toxic to these and to other plants, and that the results ascribed to toxic excretions are really due to high concentrations of the salts employed in the experiments.

The plant as an index of smoke pollution, A. G. Ruston (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 390–402, pls. 2*).—Information previously obtained (E. S. R., 33, p. 126; 37, p. 130) has been utilized in studying the effects on vegetation of pollution by coal smoke. Tabulation and discussion of data are given regarding the effects of concentrations on different plants.

Wild food plants of the Philippines, W. H. Brown (*Philippine Bur. Forestry Bul. 21 (1920), pp. 165, figs. 81*).—This bulletin gives in systematic form the scientific name, the officially adopted local name, and the names peculiar to localities in the case of each plant here discussed. Description is also given of the species and of the edible portions. The distribution of the plant is indicated.

Although wild fruits or nuts in the Philippines are generaly inferior as to quality, few in number, or difficult of access, striking exceptions are indicated. This list, though presumably not complete, is thought to be much more nearly so than any previously published.

On a form of Botrytis cinerea with colorless sclerotia, W. B. Brierley (*Roy. Soc. London, Phil. Trans., Ser. B, 210 (1920), No. B, 374, pp. 83–114, pl. 1, figs. 3*).—An account is given of the origination and study of a colorless strain of *B. cinerea*, with discussion of the probable significance of the facts observed. These are considered to lend themselves to an interpretation other than one necessarily involving mutation.

The killing of Botrytis spores by phenol, J. H. Smith (*Ann. Appl. Biol., 8 (1921), No. 1, pp. 27–50, figs. 11*).—Employing the strain of *B. cinerea* de-

scribed by Brierley in work noted above, the author shows that phenol at 0.4 per cent is fatal to spores of *B. cinerea* within a period varying from a few minutes to three hours. The curve showing the survivals at different times is sigmoid in shape, but becomes less so as the strength of the solution is progressively raised, approaching the logarithmic type. Both types of curve are explained on the assumption that the individual spores differ in resistance, and that a frequency curve showing the distribution in the resistance grades approaches the normal curve.

On the occurrence in Britain of the conidial stage of Sclerotinia mespili, H. WORMALD (*Ann. Appl. Biol., 7 (1920), No. 2–3, pp. 173–177, pl. 1, figs. 2*).—The conidial form of *S. mespili* was noted in the spring of 1920 on leaves of medlar in four localities in Kent and one in Somersetshire. Mycelium from dead blooms from the previous year gave cultures similar to those from conidia, but the Sclerotina stage was not obtained.

New species of Uredineae, XIII, J. C. ARTHUR (*Bul. Torrey Bot. Club, 48 (1921), No. 1, pp. 31–42*).—The present paper of this series (E. S. R., 45, p. 222) is based partly on newly discovered species and partly on old species which require a change of specific or generic names.

FIELD CROPS.

Plant breeding as a method of increasing crop yields, C. B. HUTCHISON (*Missouri State Bd. Agr. Mo. Bul., 18 (1920), No. 9, pp. 19, figs. 5*).—A general description of the methods and results of plant-breeding work at the New York Cornell Experiment Station.

Plant breeding experiments at the University of St. Andrews, W. ROBB (*Scot. Jour. Agr., 3 (1920), No. 4, pp. 391–402, pls. 2, figs. 2*).—The author describes experiments of the late J. H. Wilson comprising the production of new potato varieties from seedlings of hybrids, studies of inheritance of characters in oat hybrids, and work with swede and turnip selections.

[Field crops work on the Canada Experimental Farms in 1919], E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpt. 1920, pp. 9, 10, 12, 13, 14, 15, 23, 24, 27, 37–40, 40, 41, 42, 43, 50–54, 55, 64–66, 68–83, 88, 89, 98, 99, 104–106, 111, 112, 115, 116, 124, 125, 125–127, 136, 140, 146, 147, 154, 155, 158, 159, 165, 166, 168–170, 173, 174, 181, 182, 183, 186, 191, 192, 195, 196*).—The continuation of work along the same general lines as noted heretofore (E. S. R., 43, p. 734) is reported.

Variety tests with winter and spring wheat, oats, barley, buckwheat, field peas, field beans, flax for seed and fiber, winter and spring rye, vetch, corn for grain and silage, root crops for seed and forage, potatoes, clovers, alfalfa, and miscellaneous legumes and grasses for hay were conducted at the stations, substations, and farms in the several Provinces of Canada. Rotations and cultural, fertilizer, and rate-of-seeding tests, together with breeding work and extensive studies of the cost of production of various field crops were carried on in the same localities. Scutching trials with flax, tests of prairie flax straw for binder twine and rope, and a study of flax pulling machines are also noted.

Cultural, fertilizer, and variety tests with tobacco; a survey of tobacco soils; and studies of harvesting, curing, and bed management were conducted in the Provinces of Ontario and Quebec. Where steam at a pressure of 100 lbs. was used seed beds were thoroughly disinfected in 30 minutes at Harrow, Ont. Dry seed gave better results than seed sown after sprouting, and acclimated seed again proved more advantageous than imported stock. Fall preparation of plats returned a larger profit than spring preparation and with much less insect damage. Drilling fertilizer gave better results than broadcasting. In a transplanting experiment, Burley Broadleaf did best at 44 by 28 in., Burley Stand-up

42 by 26 in., and flue-cured 36 by 24 in. Warne and Hickory Pryor are indicated as the best yellow flue-cured varieties for Ontario.

Root crop experiments included variety trials, analyses, and selection work with mangels, turnips, carrots, and sugar beets, and seed production with mangels and turnips. Sugar beets from Canadian-grown seed equaled those from the best imported stock in sugar content and purity of juice. The results of investigations at Ottawa of the relative nutritive value of varieties of mangels, turnips, and carrots grown for stock use showed that with mangels, tested for 15 years, the average weight per root was 2.7 lbs., with 11.13 per cent of dry matter and 5.76 per cent of sugar. With turnips and carrots, each tested for 14 years, the respective average weights per root were 2.4 and 0.9 lbs., the dry matter contents 10.49 and 10.85 per cent, and the sugar contents 1.22 and 2.91 per cent.

Turnip stecklings stored in pits at Fredericton, N. B., did not keep well, the best preservation being in the pit with most ventilation. Cellar storage was successful until the end of March in barrels, crates, wide shallow bins and shelves, but not in deep bins. Stecklings spread 15 in. deep kept almost perfectly. When different sizes of stecklings were planted at different times, dates, and depths, the largest yield was secured from turnips above 4 in. in diameter planted 12 in. apart in 42-in. rows. In tests of mangel seed in greenhouse flats at Cap Rouge, Que., when the check was taken as 100, soaking seed in water for 15 hours gave a germination of 106, soaking in a mixture of liquid manure and water for 15 hours 104, packing the soil 99, watering daily 99, packing the soil and watering 95, mixing a complete fertilizer with the soil as in harrowing 84, applying a complete fertilizer in the row with the seed 55, mixing salt with the soil 48, and applying salt in the row 14. A careful examination of the crop from commercial seed of 51 varieties or strains of swede turnips showed that of 15 not true to type, 5 were not of the right color and 10 not of the right shape. Heavier yields of mangel seed were produced from fall setting of seed stock at a lower cost than from spring setting at Vancouver, B. C. A further attempt to grow mangel stecklings by sowing seed in summer resulted in failure.

An investigation of the influence of seasonal conditions on the composition of wheat indicated that the factors conducive to a hard berry with a high gluten content are a moderately dry soil and fairly high temperatures during the period in which the kernel is filling out and maturing.

In rate of seeding tests with oats at Cap Rouge the highest net yields per acre were returned from 3.75, 2.5, and 3.25 bu. with 2,035, 1,995, and 1,965 lbs. of grain respectively, recommending 2.5 bu. for the fertile sandy loam soil used. The rates above 2.5 bu. per acre were generally followed by larger crops of clover hay than those below 2.5. In experiments at Ivermere, B. C., oats grown continuously and receiving 12 tons of manure annually averaged 50.4 bu. per acre, seeded to clover and the clover plowed under 38.8 bu., summer fallowed 35.1 bu., and continuously, untreated, 33.5 bu.

The application to corn on a fertile sandy loam at Cap Rouge of about 500 lbs. of acid phosphate with 20 tons of barnyard manure per acre, neither affected the degree of maturity nor increased the yield.

Recent experiments with potatoes indicated that the great differences in yields of the same variety at Ottawa were not due to seed from any particular time of planting or digging, or to methods of selection or storage, but depend on whether the potatoes were grown the previous year near others with poor tops caused by some obscure physiological disease. Both Irish Cobbler and Green Mountain potatoes, planted at the Central Experimental Farm at two-week intervals from the middle of May to the end of June, showed a regular decline in yield from the first to the fourth dates of planting.

Although alfalfa strains developed through self-fertilization differed widely from each other, they were remarkably uniform within themselves. This demonstrated the possibility of producing in a comparatively short time distinct varieties recognizable with certainty in the field.

A study of the influence of the preceding crop showed that when the time required to cook field peas grown after grain was 100, it was 139 after a hoed crop, and 170 after sod.

Observations of 28 grass and clover mixtures on Prince Edward Island for four seasons indicated timothy to be the standard hay grass, and orchard grass and meadow fescue of promise for pasture either alone or together, with or without clover. In pasture studies at Lethbridge, Alta., a mixture containing alfalfa gave greater returns than mixtures omitting alfalfa. When cattle and sheep pastured on alfalfa with a good turf of grass at the base, no tendency to bloating appeared. Comparisons of mixtures at Invermere indicated that clover and grasses are better adapted than alfalfa and grasses for hay mixtures. At Cap Rouge clover produced an average of 2.69 tons of hay after barley used as a nurse crop, 2.62 tons after wheat, 2.48 tons after oats, and 1.95 tons after peas.

When Mammoth Russian sunflowers were spaced 1 ft. apart in the row, results indicated 3 ft. as the minimum row distance at Morden, Man. The yield was double that of corn. Rust control is considered necessary if sunflowers are to be used extensively as a silage crop in western Canada. At Scott, Sask., sunflowers suffered slight injury from 12° of frost on June 2, and 3° on September 2 only damaged some of the leaves on a few plants.

In cultural experiments conducted at Brandon, Man., Lacombe, Alta., and Indian Head, Sask., deep plowing gave the best results, and one plowing of summer fallow, preferably early, was found adequate. Seeding grasses following summer fallow or a cultivated crop was more successful than after grain. The best practice in breaking up sod of tame grasses and clovers, at Brandon and Indian Head, was to plow immediately after removing the hay crop and work as a summer fallow during the remainder of the season. Plowing under green crops for manure returned lower yields than bare fallow at Brandon and Indian Head, while the reverse was true at Lacombe. Manure on stubble land for wheat, oats, barley, or corn gave the best results at Brandon when applied in the fall and plowed under.

The timely use of the packer at Scott gave an increased yield, the surface packer producing consistent increases over subsurface or combination packers. Packing after seeding was always profitable, while packing before seeding was beneficial only where the seed bed was too loose. Packing appeared to most advantage immediately after plowing and after sowing. Manure plowed under gave yields superior to those from manure spread on the surface of the plowed land. Plowing under, disking, or burning stubble in the fall resulted in decreasing yields as compared with spring plowing and spring burning, particularly during unusually dry years, suggesting that the snow held by stubble during the winter is of greater value than is generally realized. The use of a nurse crop in seeding down to grass depressed the yield an average of 0.5 ton per acre.

Alfalfa seed in Argentina, W. von Petery (*Rev. de Revistas [Buenos Aires], 4 (1921), Nos. 38, pp. 15–17, figs. 13; 39, pp. 12, 13, figs. 4*).—The principal alfalfa-seed producing regions in Argentina may be divided into zones according to the homogeneity of the seed stock and characteristic weed seeds. In the irrigated zone, including San Juan, La Rioja, Salta, Jujuy, Catamarca, and parts of Mendoza, Córdoba, and San Luis, *Cuscuta corymbosa*, varieties of

C. racemosa, and sweet clover (*Melilotus parviflorus*) are especially troublesome. Other weeds occurring in numbers include *Lippia nodiflora*, *Schkuhria bonariensis*, *Bidens leucanthus*, *B. scabiosoides*, *Panicum colonum*, *Chenopodium opolifolium*, *Modiola lateritia*, *M. malvifolia*, *Anoda triangularis*, and *Sida rhombifolia*.

In seed from the second zone, which includes parts of Córdoba, San Luis, the Pampas, Buenos Aires, and the department of San Rafael in Mendoza, *Chenopodium hircinum*, *C. murale*, *Amaranthus chlorostachys*, and *A. argentinus* are the principal weeds. Cuscuta and sweet clover occur less frequently than in the first zone. Hard seeds are also frequent in seed stock, but alfalfa from this zone is said to exhibit great resistance to long droughts, strong winds, and high temperatures.

The third zone comprises the southern portion of Buenos Aires, and Rio Negro and Chubut. Seed from the two latter territories may contain as high as 50 per cent of hard seed, while that from Buenos Aires averages about 30 per cent. The principal weed seeds in alfalfa seed from this region include *Polygonum campestre*, *P. chilense*, *Rumex magellanicus*, *Cirsium lanceolatum*, *Brassica nigra*, and several species of Carex. Besides these, *Cassia aphylla*, *Atriplex pamparum*, and sweet clover occur to some extent in Rio Negro seed, and *Grindelia brachystephana* and *Luzula patagonica* are found in seed from Chubut.

Rate of culm formation in Bromus inermis, L. R. Waldron (*Jour. Agr. Research [U. S.], 21 (1921), No. 11, pp. 803–816, figs. 2*).—This contribution from the North Dakota Experiment Station reports a study of the rate of culm formation in *B. inermis*. Countings of the number of culms per plant on 97 individuals were made about every five days from June 19 to September 11, inclusive. The number of culms per plant at the first counting ranged from 1 to 5, averaging 2.37, but only the first 4 culms are considered in this analysis.

The rate of increase took place at an accelerating rate, and can be expressed symbolically by a curve of the parabolic type. Plants whose initial culmages were 1, 2, 3, and 4, respectively, became increasingly more divergent in number of culms during the season. "Given a certain number of groups of plants of *B. inermis* possessed of varying initial culmage, one may expect, with normal development, a continual increase in number of culms for each group, but at the same time with a continual increasing diversity in number of culms between the various groups according to fixed rates." The increasing divergence is explained from the initial culmages and the consequent mechanics of further culm formation rather than on the basis of different degrees of heterosis. The application of the compound-interest law (E. S. R., 43, p. 29) to culm formation in *B. inermis* was evidently without real organic significance.

[Short corolla tubes in red clover and the visiting bees], E. Lindhard (*Tidsskr. Planteavl., 27 (1921), No. 4, pp. 653–680, figs. 5*).—This article discusses the length of the corolla tube in red clover as related to the ability of bumblebees and honeybees to obtain the nectar of the blossoms and to the fertilization of the flowers incidental to the action of the bees. The results of experiments to determine the effect of bees visiting the blossoms on seed production in clover are reported, and two types of red clover with short corolla tubes, which enter into the work, are described. One of these types is known as *Trifolium pratense parviflorum*, and the other is a strain referred to as bee clover in which the corolla tube has been shortened by breeding with a view to making it as easy of fertilization through the visits of honeybees as through the visits of bumblebees.

In 1920, at the experiment station at Tystofte, the seed production of 36 plants of this bee clover was compared with that of 11 and 2 plants, respec-

tively, of two strains of common red clover. The average length of the corolla tube in the common red clover was approximately 10 mm., while in the bee clover it was slightly under 7 mm. The bee clover averaged 8,181 seeds per plant as compared with 1,747 and 935 seeds per plant, respectively, for the two strains of common red clover.

Observations made in 1911 indicated that early in the blossoming period only the queen bumblebees visited the clover blossoms, while about the middle of June approximately 20 per cent and during the first week of July about 60 percent of the bumblebee visits were made by the workers, and after that time the queens practically discontinued their activity in this line. Other observations were made on unit areas in clover fields in 1920. On July 16 it was observed that the early clover area was visited by about 150 bees per hour, of which 114 were honeybees. The late clover area on July 31 was visited by 171 bees per hour, of which only 18 were honeybees, and on the same day on an area of second growth early clover 231 bees per hour, including 57 honeybees, were observed.

Special attention was given to the manner in which the bees obtained the nectar from the flowers. On the first area 30 bees went down the corolla tube to the nectar while the rest of them took the nectar through openings made in the side of the tube. On the other two areas 93 and 117 bees, respectively, worked straight down the corolla tube. A comparison of the number of bees found at different periods of the day, on equal areas of the so-called bee clover and of the common red clover, showed an average of 18.6 bees visiting the bee clover and all of them getting the nectar by going down the corolla tube, while an average of only 9.8 bees visited the common red clover and nearly all of them reached the nectar through openings made in the side of the tube. It is pointed out in general that the reduction of the length of the corolla tube in the bee clover type made it possible for honeybees to reach the nectar with greater facility, thereby becoming a more important factor in the fertilization of its blossoms.

The effect of a varying supply of nutrients upon the character and composition of the maize plant at different periods of growth, F. L. Duley and M. F. Miller (*Missouri Sta. Research Bul. 42 (1921), pp. 3–58, pls. 8, figs. 17*).—Maize plants were grown in sand cultures with Pfeffer's nutrient solution of normal and N/20 concentrations in all possible combinations in three 30-day periods of growth.

The second 30-day period was found to be decidedly the most important in the production of vegetative parts of the plants. Ear production was confined entirely to the third 30-day period. The growth of tops was increased by the optimum supply of solution, regardless of the period in which supplied. A low supply of nutrient solution was conducive to increased root weight and to fibrous root development, particularly during the last period.

The ratio of roots to tops became wider as the plants grew older or as the concentration of the nutrient solution was increased. With minimum nutrient at the end of the first period the weight of roots constituted 61.18 per cent of the total plant weight, but at the end of the third period where optimum nutrient had been supplied throughout the three periods, the weight of roots was only 12.29 per cent of the total weight. Optimum nutrient during the third period largely determined ear production, but where a copious supply of material elements was present at the end of the second period the leaves and stalks contained material sufficient to produce fair ears even where the third period had minimum nutrient.

The nitrogen and potassium in the plants were approximately proportional to the supply of nutrients during the period just previous to harvest. The phosphorus was influenced much less by a variation in the nutrient supply. With the different treatments, the amounts of calcium and magnesium present were more constant than those of the other elements. However, the calcium showed considerable variation in the roots and leaves. The corn plants seemed incapable of taking up these elements in excessive amounts, notwithstanding a plentiful supply in the nutrient solution. The percentage of magnesium was higher than the percentage of calcium in the ears, but was less in all other parts of the plant. The proportion of the total nitrogen of the plant contained in the roots increased whenever minimum nutrient was supplied. In plants where the growth was nearest normal more than half the nitrogen in the tops was contained in the ears. In plants of the greatest development, the proportion of potassium in the roots was increased during the third period, apparently indicating loss of this element from the tops or possibly a return of some to the roots by downward movement from the aerial parts.

In all treatments and in each period, minimum nutrient supply allowed a greater proportional storage of nitrogen, phosphorus, and potassium in the roots than did optimum nutrients. Minimum nutrient supply reduced the length of internodes, especially where the plants had received optimum nutrient during the first period.

Composition of cotton seed, C. F. Creswell and G. L. Bidwell (*U. S. Dept. Agr. Bul. 948 (1921), pp. 221, pl. 1, figs. 11*).—Issued for the guidance of producers, dealers, and crushers, this bulletin sets forth data showing as far as possible approximate oil and meal yields of cotton seed in each county of the cotton belt. Records of analyses of 46,029 samples made by company and commercial chemists during the five seasons 1914–15 to 1918–19, inclusive, were collected from the original analytical sheets and used in this study. The several tabulations indicate the quantity of cotton seed crushed in different States by years, the quantity of crushing seed produced, total products yielded and manufacturing loss per ton of seed, oil and meal yields per ton of seed, yields of oil and meal by States, by counties, and by months, as compiled from analyses, and variation of yields of oil and meal on the same market. Outline maps of the different States show the average yields of oil per ton of seed by counties in ranges of 15 lbs. The authors urge the elimination of foreign matter and prevention of damage of seed.

"A careful study of the figures here presented, together with a study of present-day conditions, will show that if the composition of commercial lots of cotton seed as shown by analyses were known to a greater extent, it would be better for both buyer and seller, and probably the quality of seed would improve greatly. . . . It doubtless will be a distinct forward step when all mills have their seed analyzed and keep close watch of actual yields so that any mechanical or other defect that reduces yields can be immediately discovered and remedied. Analyses also could be of more use to all concerned in determining the value of seed for selling and purchasing, and it is believed that all producers would be well paid for having a sample of each car of uniform seed analyzed so that it might be sold on a basis of actual value."

Flax variety trials, J. de Vilmorin (*Jour. Agr. Prat., n. ser., 35 (1921), Nos. 19, pp. 369–371; 21, pp. 410–412, figs. 2*).—Pskoff, a Verrières pedigree selection, and U. S. Selection 1803, with fiber 1.25 and 1.15 meters long, respectively, ranked highest in trials of 63 fiber flax varieties at Verrières in 1920.

The effect of spacing on horse beans, HEUSER (*Fühling's Landw. Ztg., 69 (1920), No. 9–10, pp. 185–192*).—Where horse beans were planted at distances of 7.5, 10, 15, 22.5, and 30 cm. in 30 cm. rows, the narrower spacings resulted in vigorous early development, lengthening of lower internodes, shorter flowering period, earlier ripening, shorter thinner stalks, and greater seed production. Full development was attained in the 30 by 30 cm. (11.7 by 11.7 in.) spacing. As in the experiments of Claus with barley (E. S. R., 31, p. 330), grain percentage was independent of distance. The highest weight of grain per hectare was secured by large seeded varieties sown 10 by 30 cm. at the rate of 246.6 kg. per hectare, and smaller seeded when sown 7.5 by 30 cm. at 191 kg. For trials of progenies and selections, spacing of 20 by 30 cm. is recommended for large seeded varieties and 15 by 30 cm. for small seeded varieties.

Report on field trials with varieties of mangels, T. MILBURN and R. RICHARDSON (*County Council Lancaster Ed. Com., Agr. Dept., Farmers' Bul. 33 (1919), pp. 12*).—Red Intermediate with 37.83 tons, Prizewinner with 37.25 tons, and Prizetaker with 36.4 tons per acre made the highest average acre yields in tests of mangel varieties conducted in Lancashire from 1915 to 1919, inclusive.

The culture of Phalaris bulbosa in Uruguay, J. PUIG Y NATTINO (*Uruguay Rev. Min. Indus., 9 (1921), No. 58, pp. 226–260, figs. 6*).—Cultural directions suitable for the production of *P. bulbosa* in Uruguay are presented, together with results of cultural trials with the crop and comparative analyses. See also a previous note (E. S. R., 43, p. 830).

Report on potato trials, 1920 (*Jour. Min. Agr. [London], 28 (1921), No. 4, pp. 350–357*).—In trials with potato varieties in 455 centers in England and Wales, Epicure with 11.55 tons per acre was the highest yielding early variety, Great Scott was first of the second earlies with 11.65 tons, and Kerr Pink headed the late or main crop varieties, with 13.1 tons. In the first early crop, varieties immune to wart disease averaged 7.65 tons per acre as compared with 9.8 tons as the average of susceptible varieties.

Report of field trials with varieties of potatoes [in Lancashire, 1918–1920], T. MILBURN, R. RICHARDSON, J. J. GREEN, and C. P. MAY (*County Council Lancaster, Ed. Com., Agr. Dept., Farmers' Buls. 31 (1918), pp. 8; 32 (1920), pp. 8; 35 (1921), pp. 7*).—In tests of potato varieties immune to wart disease Ally, Kerr Pink, and Great Scott made the highest yields, while Tinwald Perfection and Kerr Pink were decidedly best in cooking qualities.

Experiments of the German Potato Culture Station in 1920, C. VON ECKENBRECHER (*Illus. Landw. Ztg., 41 (1921), No. 17–18, pp. 74, 75, figs. 16*).—Results of variety tests in 1920 are presented, with illustrations of the principal varieties tested. Blücher, Weddigen, and Kartz von Kameke made highest yields of tubers with 445.4, 405.4, and 393.5 bu. per acre, respectively, while Klein-Spiegeler Wohltmann, Blücher, and Parnassia possessed the greatest starch content with 18.9, 18.4, and 18.3 per cent, respectively. Grouped in order of starch production per acre, Blücher with 4,957 lbs., Klein-Spiegeler Wohltmann with 4,459 lbs., and Weddigen with 4,139 lbs. were the leading varieties.

Potato variety records, K. SNELL (*Illus. Landw. Ztg., 41 (1921), No. 17–18, p. 74, pl. 1, figs. 7*).—The author outlines and illustrates the methods of the German Research Institute for Potato Culture in securing accurate data on the different potato varieties.

Svalöf Stål rye, E. W. LJUNG (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 3, pp. 95–101*).—The results of tests of varieties of rye, conducted at Svalöf

and a number of other points in Sweden from 1915 to 1920, inclusive, are reported.

At Svalöf, Stål rye stood first in average yield for the period with 4,385 kg. per hectare (69.69 bu. per acre), followed by Svalöf Stjärn, Svalöf 0280, and Petkus, with 4,232, 4,110, and 4,013 kg. per hectare, respectively.

At Ultuna, the average result was slightly in favor of Stjärn rye, the yields being 3,522 kg. per hectare for Stjärn and 3,481 kg. per hectare for Stål rye. The average yields for the six years at Tornby and Alnarp were in favor of the Svalöf Stål variety, and the average yields secured in seven different local experiments, varying in duration from two to five years and in number from two to ten tests at the different points, were also in favor of this variety. The conclusion is drawn that Svalöf Stål rye has a yielding capacity at least as high as that of Svalöf Stjärn rye.

Relation of size of beet seed balls to yields of beets, I. URBAN (*Ztschr. Zuckerindus. Czechoslovak. Repub., 44 (1920), pp. 151–155; abs. in Ztschr. Pflanzenzücht., 7 (1920), No. 4, p. 339; Sugar [New York], 23 (1921), No. 9, p. 490*).—The beet seeds used in experiments during a 10-year period were grouped according to weight, and the higher seed weight was found to correspond to the highest yield of rooots, notwithstanding variation apparently due to weather conditions during seed harvest. Seed averaging 1.895 gm. and 1.639 gm. weight per 100 seed balls produced average acre yields of 29,628 and 28,694 lbs. of roots, respectively. When varieties differing in average weight of seed balls were grouped, like results were obtained at harvest, the varieties with heavy seed ball weights giving the largest beet yields.

Cost of producing sugar beets in Utah and Idaho, 1918–1919, L. A. MOORHOUSE and S. B. NUCKOLS (*U. S. Dept. Agr. Bul. 963 (1921), pp. 41, figs. 13*).—Data are given on the cost of producing sugar beets based upon 220 farm estimates obtained from beet growers in five irrigated districts, Lehi and Garland, Utah, and Idaho Falls, Blackfoot, and Twin Falls, Idaho. The various cultural and field operations are described, their man-labor and horse-labor requirements are given for each district, and the total average labor requirement is analyzed by districts. Farm practices in growing sugar beets for three districts in Utah and Idaho have been described in another publication (E. S. R., 39, p. 640.)

The cost per ton of beets ranged from $5, in two instances where yields averaging 24 tons per acre were obtained, to $35 in the case of one grower who harvested but 3 tons per acre. The acre yields on the 220 farms averaged 13.7 tons. Although the average cost was $9.49 per ton, this rate was exceeded on nearly half the farms. Seventy-two per cent of the growers produced beets at a cost of $11 per ton or less. Labor constituted from 69 to 75 per cent of the costs exclusive of land rent; material, 7 to 10 per cent; and insurance, taxes, overhead, and miscellaneous expenses 17 to 30 per cent.

Anatomical and physiological studies on sugar cane in Cuba, E. M. DE CALVINO (*Cuba Estac. Expt. Agron. Bol. 46 (1921), pp. 49, figs. 21*).—Experiments in the production of seedling canes in Cuba are reported, and the technique of hybridization and the methods of other experimenters discussed.

Sugar cane generally arrows in Cuba from December to March, and some varieties as late as the last of April. Eighteen varieties never flowered at the Cuba Experiment Station, while Cristalina, Natal Uba, and many of the station seedlings arrowed annually. In the varieties grown at the station, pollen grains seldom occurred aborted and morphologically abnormal on account of lack of starch. Pollen remains normal in all arrows of some varieties from December to March, while in other canes the inflorescence contains aborted pollen in Febru-

ary and March. However, Natal Uba produced inflorescences with aborted pollen from December to March and one with much normal pollen at the end of April. A variety coming from one locality may possess arrows with normal pollen, and when coming from other places, arrows with aborted pollen.

While pollen of sugar cane did not germinate on the ordinary culture media, the viscous stigmas of flowers of Havana tobacco were used with success. The presence of starch in the styles did not appear to be characteristically connected with the fertility of the ovaries, because such varieties as C 7, C 30, C 37, and H 109, in which the examinations for starch in the inflorescences resulted negatively, gave fertile seed with natural as well as artificial pollination.

The time required for the germination of sugar cane seed in these experiments ranged from 3 to 8 to 10 days. Ordinarily from 5 to 6 days are required in sterile propagation boxes.

On the viability of sugar cane pollen, C. A. B[ARBER] (*Internatl. Sugar Jour., 23 (1921), No. 266, pp. 71, 72*).—In a communication to the author, T. S. Venkataraman states that cane pollen germinated very satisfactorily on stigmas of *Datura fastuosa alba* and *Hibiscus vitifolia.* It was found with this test that under ordinary conditions the pollen lost its viability in less than an hour. With a special chamber this period was extended to 4 hours, and by erecting crates over the whole cane with its arrows, pollen was kept viable for 6 days. A later communication states that the period of enforced viability was extended to 2 weeks.

Experiments with sugar cane seedlings in St. Croix, L. SMITH (*Abs. in Science, n. ser., 54 (1921), No. 1388, p. 118; also in Sugar [New York], 23 (1921), No. 8, p. 447*).—This work has been noted from another source (E. S. R., 45, p. 126).

Sugar cane experiments, 1918–1920, J. DE VERTEUIL (*Trinidad and Tobago Dept. Agr. Bul., 19 (1921), No. 2, pp. 66–80*).—The experiments reported, in continuation of previous work (E. S. R., 44, p. 735), embraced tests of seedlings and varieties. Seedlings raised from Bourbon gave the largest cane yields and those from L. 511, B. 6835, and a Hawaiian cane (H?) the best juice. In field trials, the best results were obtained from B. 6388, B. 14761, Ba. 6032, M. P. 55, B. H. 10 (12), and H?, with 4.22, 4.1, 3.95, 3.87, 3.69, and 3.67 tons of indicated sucrose per acre, respectively.

Summary of results of fertilizer and other field work with sugar cane for 1919–1920, C. B. GOUAUX (*La. Agr. Col. Ext. Circ. 47 (1921), pp. 20*).—Results of sugar cane fertilizer demonstrations are reported, together with notes on varieties, diseases, insect pests, fertilizing, liming, and cover crops. A mixture of 150 lbs. of sulphate of ammonia and 500 lbs. of acid phosphate gave the best returns with plant cane, with an increase of 7.85 tons of cane per acre over the check at a net gain of $35.90. On first year stubble, applications of a mixture of 300 lbs. of nitrate of soda and 250 lbs. of acid phosphate made an increase of 12.37 tons at a net gain of $63.75.

Report on field trials with varieties of swedes, T. MILBURN and W. IRONS (*County Council Lancaster, Ed. Com., Agr. Dept., Farmers' Bul. 34 (1920), pp. 12*).—In variety trials of swedes at various centers in Lancashire during the period 1912 to 1919, a remarkable uniformity existed between the average yields, which ranged from 26.08 tons from Empire to 24.24 tons from Lord Derby. The latter was particularly susceptible to finger-and-toe disease, mildew, and brown rot, while Halewood was comparatively free from finger-and-toe disease and mildew.

Sweet clover as a farm crop, C. A. ZAVITZ (*Ontario Dept. Agr. Bul. 283 (1921), pp. 32, figs. 13*).—Information is presented regarding the results of

experiments with sweet clover conducted at the Ontario Agricultural College since 1891, and work with the crop at other points in Canada and in the United States is briefly noted. The experimental work at the college included production tests of hay, fodder, and seed; time of cutting and date and rate of seeding tests; hay, pasture, silage, green manuring, and inoculation trials; comparisons of unhulled, hulled, and scarified seed, and seed from various sources; and trials of improved strains and new varieties.

Varietal trials with spring wheat in North Dakota, T. E. STOA (*North Dakota Sta. Bul. 149 (1921), pp. 55, pls. 2, fig. 1*).—A compilation is presented of results from comparative trials of spring wheat varieties conducted for various periods between the years 1892 and 1920 at the station, at Edgeley, Dickinson, Hettinger, Langdon, and Williston Substations, and at the Northern Great Plains Field Station of the U. S. Department of Agriculture at Mandan. The field work at several points and the milling and making experiments were in cooperation with the U. S. Department of Agriculture. The work at Williston, Dickinson, and Mandan has been noted from another source (E. S. R., 44, p. 141). Besides yield and meteorological data, agronomic data are tabulated, including number of days from emergence and from heading to maturity, height of plant, straw yields, weight per bushel, percentage of stem-rust infection, yield and water absorption of flour, and color, volume, and texture of loaf. The principal varieties are grouped, and brief descriptions, with notes on the origin and history, are given of each.

Marquis is indicated as outstanding among the common wheats over the greater part of the State, although slightly outyielded by Power in the northwestern section, where stem rust was not a great factor in influencing yield. Although not resistant to stem rust, the earliness of Marquis (E. S. R., 44, p. 637) aids to escape infection to a greater degree. Power, Haynes, and Preston are highly susceptible. Kota (E. S. R., 41, p. 535) is superior to Marquis in stem rust resistance and apparently in drought resistance, is a high yielder, and appears to be a first-class milling and baking wheat in every respect. Flour from Marquis wheat excels that from other commercial varieties for bread-making purposes. Varieties grown in the drier sections of the State produce stronger flour than when grown in eastern North Dakota, where the moisture supply is more plentiful.

Durum wheats generally gave higher acre yields than common wheats, growing more vigorously and usually exhibiting greater resistance to drought and rust. Flour from durum wheat, however, does not have the strength of gluten associated with flour from common wheats. Of the commercial amber durum varieties, Kubanka is superior to Arnautka. Monad, a variety of more recent origin, exceeded Kubanka in yield and rust resistance, but its flour does not give quite so large a loaf when baked. Acme appears and behaves quite similar to Monad. Although the red durum variety D-5 yields well and is least susceptible to rust, its milling and baking qualities are distinctly inferior to all other varieties and it is considered unsatisfactory for macaroni and other edible pastes.

Winter wheat in North Dakota, L. R. WALDRON (*North Dakota Sta. Bul. 151 (1921), pp. 8*).—The culture of winter wheat has not proved successful in North Dakota, although fairly profitable in certain areas of adjacent States. Long continued periods of low winter temperature, occasionally supplemented by dry autumns, alternate freezing and thawing in the spring, and extended winter and spring droughts are indicated as responsible for the failure of the crop in the State.

In experiments at Fargo, Langdon, and Edgeley, in the eastern half of the State, winter wheat was almost uniformly a failure. Although conditions were

more favorable at Williston and Dickinson, in western North Dakota, comparative yields show winter wheat to be only about one-half as productive as the best varieties of spring wheat. Successful crops were secured in only 25 per cent of the trials conducted with wheat on the 82 State demonstration farms from 1910 to 1914, inclusive. In many of these cases the yields were lower than those of spring wheat on the same farms.

Effect of various media and corrosives on germination of field seeds, M. HEINRICH (*Landw. Vers. Sta., 98 (1921), No. 1–2, pp. 65–115*).—The experiments described dealt with the effect of various sand types, moisture content of seed bed, depth, thickness of cover layers, and corrosives on the germination of field seeds.

Fine sand, less than 1 mm., was not favored as a germinating medium, as the formation of clods and cracks in the cover layers was unavoidable. Clod formation decreased with an increase in size of sand. High moisture content and increased depth did not favor vigorous germination, but as long as extremes were not employed neither factor was appreciably harmful. The detrimental effects were greater with fine diluvial sand than with coarse glass sand. Seed inclined to mold showed greatest fungus growth at 3 cm. depth, and decayed when buried as deep as 5 cm.

Dry sand proved to be an excellent cover material when not so fine as to condition capillary attraction of water from the subsoil. Quartz sand with grains from 1 to 1.25 mm. in size was most effective. Up to 5 cm. depth of insertion was of small importance. The dry cover strata limited mold growth locally, and prevented overlapping of neighboring seed. Dry coarse sand of 2 mm. diameter and larger impaired germination to such an extent that a return to normal growth conditions did not effect a recovery.

Root crop seed production in 1919 and the market of 1919–20, L. HELWEG (*Tidsskr. Planteavl., 27 (1921), No. 3, pp. 495–512*).—Statistics are given regarding the area and yield in Denmark of sugar beets, mangels, turnips, Swedish turnips, and carrots grown for seed in 1919, and the results are compared with those of earlier years. The returns per hectare from some of the kinds of seed are shown for a series of years, and domestic and foreign market conditions relating to the commodity in the winter of 1919–20 are discussed.

[A system of points for grading seeds], J. N. WALLDÉN and H. WITTE (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 3, pp. 102–121*).—This article is a discussion of the objects and principles involved in determining the value of seeds in exhibits, together with the plan and application of a system of points for the purpose. The different subjects considered are as follows: Object of seed exhibits, conditions governing participation in such exhibits, analyses of seeds exhibited, judging of displays as a whole and of the seeds on the basis of a system of points, comparative valuation of the different characters in the various kinds of seeds, and assignment of prizes. The seed characters mentioned as determining the value and their respective ratings are germinating ability 15, purity 10, weight per thousand seeds 5, color 5, uniformity 5, moisture content 0, odor 0, and mechanical injury 0. The last three characters mentioned are regarded as negative, so that their highest value is represented by 0.

A method for determining purity of small-kerneled seeds, J. N. WALLDÉN (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 3, pp. 133–136*).—The method is described, the formulas involved are explained, and the use of the method is demonstrated by its application to supposed samples of orchard grass and meadow foxtail.

Seed trade rules adopted by wholesale grass seed dealers at St. Louis (*Seed World, 10 (1921), No. 1, pp. 33, 40*).—The trade rules effective August 1,

1921, cover contracts, terms of payment, shipment and delivery, sale by samples, analysis, and other details affecting both buyers and sellers.

Agricultural seed law (*Iowa State Dairy and Food Comn. [Pamphlet], 1921, pp. 7*).—The provisions of the law effective July 1, 1921, regulating the sale of agricultural seeds in the State of Iowa.

The new Iowa seed law, H. Bebb (*Seed World, 9 (1921), No. 12, pp. 23, 24*).—A summary of the above with comment.

New Nebraska seed law, H. Bebb (*Seed World, 10 (1921) No. 3, pp. 36, 41*).—A summary of the Nebraska seed law approved April 21, 1921, with comment.

Summary of the seeds regulations, 1921 (*Jour. Min. Agr. [London], 28 (1921), No. 4, pp. 370–374*).—The main provisions of the regulations under the Seeds Act, 1920, concerning transactions in field, garden, and forest tree seeds in Great Britain are given, and the requirements under this act are compared with those of the Testing of Seeds Order, 1918 (E. S. R., 42, p. 439).

New law governs English seed trade (*Seed World, 10 (1921), No. 5, pp. 19, 20*).—Essentially noted above.

Agricultural seed inspection, J. L. Hills, C. H. Jones, et al. (*Vermont Sta. Bul. 220 (1921), pp. 23–32*).—Purity guaranties, percentages of germination, and the numbers of weed seed per pound are tabulated for 254 samples of agricultural seed gathered during June, 1920, from local dealers in the State.

Seed testing in Bavaria, 1913–1918, L. Hiltner and G. Gentner (*Landw. Jahrb. Bayern, 9 (1919), No. 4, pp. 171–246*).—Results are reported of germination and purity tests and variety proving trials of seeds of grains, legumes, grasses, root crops, and fiber crops conducted by the Agricultural Botanic Institute at Munich during the period from July 1, 1913, to July 1, 1918, together with a report on seed control in Bavaria during the war.

HORTICULTURE.

Meeting of the Great Plains section of the American Society for Horticultural Science, M. J. Dorsey (*Minn. Hort., 49 (1921), No. 10, pp. 259–262, figs. 3*).—A brief account, based on an inspection trip, of horticultural activities at several Canadian agricultural institutions. A new seedling apple, Melba, at the Central Experimental Farms, Ottawa, and a new muskmelon, Oka, at the Trappist Monastery at Oka, Quebec, are noted.

[Report on horticultural work for the year ended March 31, 1920], W. T. Macoun et al. (*Canada Expt. Farms Rpt. 1920, pp. 12, 14, 15, 25–27, 28, 100, 106, 112, 127–129, 133–135, 147–150, 174, 175, 186, 187, 196, 197*).—A report similar to that of the preceding year (E. S. R., 43, p. 741), in which the horticultural work at the Central Farm is briefly reviewed, and notes are given on cultural and variety tests of fruits, vegetables, and ornamentals at the branch farms and stations.

Plant inspection and quarantine report, 1918–19, E. G. Smyth (*Porto Rico Dept. Agr. and Labor Sta. Bul. 23 (1919), pp. 61*).—A review is given of plant quarantine activities in Porto Rico for the period from July, 1910, to July, 1919, including tabulated lists, chronologically arranged, of the plants, fruits, and seeds intercepted, giving the source of the shipment and the name of the infesting insect. A paper is included entitled Cooperation in Plant Inspection and Plant Quarantine Service, by J. Matz, relating to plant diseases and containing a list of the principal Porto Rican crops and their diseases.

Plant inspection and quarantine report, 1919–20, L. A. Catoni (*Porto Rico Dept. Agr. and Labor Sta. Bul. 27 (1921), pp. 3–22*).—A record of activities for the year 1919–20, including the recommendations of the newly organized

plant quarantine and inspection board. Tabulated lists are given of the inspections made at the ports of San Juan, Mayaguez, Ensenada, and Ponce during the year and of insect pests and diseases intercepted.

Importance of carbon dioxid as a fertilizer for vegetables, F. RIEDEL (*Gartenwelt, 25 (1921), Nos. 31, pp. 302–304, figs. 3; 34, pp. 336–338, figs. 2*).—The investigations reported, similar to those of Jess, previously noted (E. S. R., 45, p. 344), deal with the stimulating effect of carbon dioxid on the growth and yield of vegetables both in the greenhouse and field. In this instance, in the greenhouse, gas-treated cucumber, tomato, bean, and cauliflower plants greatly outyielded the untreated; in the open, treated spinach and potatoes yielded more than twice the untreated. It was found that the increase due to carbon dioxid was accentuated under conditions of high soil fertility. Applications of carbon dioxid are said not only to notably increase yield but also to produce a better flavored product, to shorten the growing period, and to increase the resistance of the plant to disease.

Reliability of the nail test for predicting the chemical composition of green sweet corn, C. O. APPLEMAN (*Jour. Agr. Research [U. S.], 21 (1921), No. 11, pp. 817–820, fig. 1*).—This is a further contribution from the Maryland Experiment Station to studies of the ripening of sweet corn (E. S. R., 45, p. 134), in which are presented data relative to an investigation of the accuracy of the nail test for determining the various stages of ripening. In this study four different grades of development are considered, namely, premilk, milk, early dough, and dough, differentiated according to the nature of the exudation forced out of the kernel by the pressure of the thumb nail. Two crops of Stowell Evergreen, an early and a late, were used as the source of material. The average hourly mean temperature for the early crop was 83° F. and for the late 65°.

Determination of the moisture, total sugars, and starch made in connection with the nail tests are given in tabular form, and indicate in part that "the nail test is most reliable when applied to crops which ripen slowly in the cool autumn. These crops are most suitable for experimental work requiring the sampling of ears as nearly as possible at the same stage of ripening. . . . The reliability of the nail test is influenced by the rate of ripening and also by the rate of water loss by evaporation. . . . In each of the ripening stages except the dough stages the percentage of total sugar was more constant than the percentage of starch. As ripening proceeds, the increase in the percentage of starch is much greater than can be accounted for by the decrease in the percentage of sugars. From the beginning of kernel formation until the end of the ripening period there is a continual movement of sugar from the plant into the kernels, where it is transformed into starch."

The fertility and fruiting habit in Cucurbita, J. W. BUSHNELL (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 47–51*).—A discussion is given of certain experimental phases of a project begun at the Minnesota Experiment Station in 1914 in the improvement of Hubbard squash by the isolation of desirable types from the ordinary commercial stocks. After several partially successful attempts to perpetuate selections by self-pollination, it was found that by pollinating every pistillate bloom some fruit could be induced to set on every plant, thus indicating that the strains under study were all self-fruitful. A study of the factors influencing setting showed that weather, time of day, stage of receptiveness, and size of bloom had no particular significance. A certain periodicity in fruit setting was observed in that the first blooms usually failed, followed by a successful set, this in turn being succeeded by a period of failure.

The effect of "nipping" muskmelon vines, J. W. Lloyd (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 126–128*).—Pinching tests with the muskmelon, conducted in Union and Marion Counties, Ill., resulted in slightly increased yields of early melons from the treated vines. The total yield, however, was in favor of the normal vines.

Government inspection of fruit shipments, W. H. Darrow (*Vt. State Hort. Soc. Ann. Rpt., 17 (1919), pp. 21–29*).—A paper relating to the activities of the Bureau of Markets, U. S. Department of Agriculture, in assisting the fruit grower to market his crop.

Lessons to be derived from the Ozark orchardists, C. S. Bouton (*Tenn. State Hort. Soc. [etc.] Proc., 16 (1921), pp. 60–67, fig. 1*).—Practical observations are given on the apple-growing industry in the Ozarks, drawing attention to the multiplicity of apple varieties.

First 15 years of a 40-variety apple orchard: Apple scion selection, M. B. Cummings (*Vermont Sta. Bul. 221 (1921), pp. 3–38, pls. 4, figs. 5*).—A presentation of data on the first 15 years' performance of 40 apple varieties in the station orchard and a preliminary report on a study in inheritance of yield in the apple as indicated by the production of scions taken from high and low yielding trees.

The varietal data, presented largely in tabular form, show among other things that Boiken, Chenango, and Longfield were among the earliest to bear; that Cooper, Roman Stem, and Northern Spy were slow to fruit; that Yellow Transparent was especially productive; and that Mann was an exceptional keeper, enduring 321 days in common storage. Baldwin and Rhode Island Greening were among the varieties injured by the severe winters of 1917–18 and 1918–19.

The scion selection experiment, started in 1910 to test the comparative value of scions from high and low yielding apple trees of the same variety is briefly reported upon and a yield table included. "The scions derived from productive trees have done no better as the whole, in fact up to date they have done scarcely as well, as those secured from unproductive trees. . . . Another 10 years must doubtless elapse before sufficient data are accumulated to warrant one in drawing valid conclusions as to the basic question involved in this experiment. However, it is safe to say that the results thus far secured, because of their inconsistency, do not justify deduction except that they clearly do not afford affirmative support to the scion selection idea."

Wild apples at Tran-Ninh (Laos), R. Miéville (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 2 (1920), No. 7, pp. 204–207*).—Four of the many species of wild apples growing in the vicinity of Tran-Ninh are described. Although the author has been unable to graft these apples successfully with improved French varieties, nevertheless the native fruit is deemed of value for cooking and for the manufacture of cider. Late-blooming varieties are irregular yielders because proper pollination is often prevented by heavy rains.

Orchard soil management studies in Indiana, L. Greene (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 185–190*).—A further discussion of the results of the soil management investigations at Laurel, Ind. (E. S. R., 45, p. 133), in which the author points out that soil moisture is a very important factor in determining the yield of the different plats. The total yield, including 1920, for the tilled plat has been 86 bbls., for the straw mulch 82 bbls., and for the straight sod 12 bbls. Sod mulch is deemed a satisfactory and necessary treatment for rough hillside orchards provided sufficient material is applied to conserve moisture.

Preliminary report on the effect of fertilizers in apple orchards in the Ozark region, J. R. COOPER (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 190–193*).—A progress statement of nutritional and fruit spur studies with the apple at the Arkansas Experiment Station.

On poor leachy soils the use of nitrogenous fertilizers was found to increase the set of fruit and to assist in carrying the set fruits through to maturity whereas on the same soils applications of potash and phosphoric acid had no apparent influence. On fertile soils the use of nitrogen had little or no effect.

Studies in fruit spur formation and performance led the author to observe that position on the tree and amount of available light are very important factors. The control of the water and nitrogen supply is deemed the most potent means of influencing spur activities. Pruning, on the other hand, is believed to affect only a few of the spurs in the immediate vicinity of the cut.

Both pruning and applications of quickly available nitrogen were found to increase the percentage and rapidity of pollen germination, the second practice giving the more positive and uniform results. The use of excessive amounts of nitrogen in a few instances was found to cause a considerable distortion of the floral parts and to decrease the vitality of the pollen.

Pruning young apple trees, J. A. NEILSON (*Canad. Hort., 44 (1921), No. 10, p. 161*).—The results of a comparative test of summer, winter, and no pruning on young Northern Spy and McIntosh apple trees in five Ontario orchards are presented in tabular form with discussion, and indicate that no pruning is superior to the other two in respect to the stimulation of early bearing. The unpruned trees also made the largest growth, with the winter pruned trees second.

Pruning for increased color and yield, C. C. VINCENT (*Idaho State Hort. Assoc. [Proc.], 19 (1920), pp. 77–81*).—The author points out the value of summer pruning in increasing the yield, size, and color of apples, as indicated by Idaho Experiment Station experiments, already noted (E. S. R., 34, p. 738).

An experience in self-fertilization of the peach, C. S. CRANDALL (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 33–37*).—Statistical data are presented relative to the results of pollination studies with the peach at the University of Illinois.

The investigations, conducted partly in the orchard and partly in the greenhouse, indicate in general that only a relatively small proportion of the pollinations are successful as measured by the number of seedlings actually planted in the test orchards. This was especially true in the greenhouse work, where a total of 1,955 pollinations resulted in only 27 trees, one tree for every 72.4 flowers. In the orchard operations 1,207 pollinations of previously emasculated flowers yielded 189 trees, and 1,230 protected but untreated blooms yielded 60 trees. To sum up, orchard pollination was more successful than greenhouse pollination, and of the two methods of pollination practiced in the orchard, namely, natural and hand-pollination preceded by emasculation, the latter gave the better results.

Correlation and growth in the branches of young pear trees, H. S. REED (*Jour. Agr. Research [U. S.], 21 (1921), No. 11, pp. 849–876, pl. 1, figs. 7*).—A quantitative study of the relationships of laterals produced by the young upright branches of pruned and unpruned Bartlett pear trees. A closely related paper by the author and Halma has been previously noted (E. S. R., 44, p. 133).

The trees upon which the observations were made were planted at the Citrus Experiment Station, Riverside, Calif., in 1916. The 91 pruned trees were systematically headed back each year after planting, while the 25 unpruned

were allowed to grow without cutting since the initial year. At the time of taking records none of the trees had fruited. Measurements were made in February, 1920, on upright shoots of 1918 origin and the laterals produced thereon in 1919, including 270 mother shoots and their progeny from the pruned trees and 54 shoots and progeny from the unpruned trees.

The data presented, partly in tabular and graphical form, are arranged under three general headings: (1) Growth and differentiation of laterals, (2) dominance of the distal laterals of the pear tree, and (3) production of fruit spurs.

"Mother shoots which had been headed back in the previous winter produced about 65 per cent greater total growth of laterals than their unpruned neighbors. The frequency distributions of laterals on both classes of mother shoots show a positive skewness, which is taken to indicate a tendency to produce more than the mean quantity of wood. . . . The severity of the pruning seemed to have little influence upon the total amount of new laterals produced in the following season. The growth response showed little tendency toward a 'restoration of lost parts.'

"The longest lateral on a mother shoot is usually at the distal end, and each successively lower lateral is usually shorter than the one above it. . . . Variability in the length of laterals tends to increase as their distance from the distal end of the mother shoot increases. The lateral arising from the distal end of an upright mother shoot exerts a well-marked dominance over those arising from buds beneath it. The mother shoots which were most reduced in length by pruning usually produced longer distal laterals. . . . Fruit spurs were commonly more abundant upon unpruned mother shoots than upon those receiving pruning in the previous winter.

"The growth response indicates that increased growth following pruning is due to the removal of regions containing, or producing, substances which would otherwise tend to inhibit growth of other members of the system."

Prune growing in California, A. H. Hedrickson (*California Sta. Bul. 328 (1921), pp. 3–38, figs. 12*).—A compilation of general information relative to the culture and curing of prunes. Particular emphasis is placed on top-working and rejuvenation of old orchards, pruning of young and mature trees, and on irrigation, as well as diseases and insect pests. Data on the cost of production are included.

Pruning notes on blackberry varieties, A. S. Colby (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 241, 242*).—On the basis of a careful study of the fruiting habit of blackberry varieties at the University of Illinois, the author separates these into three groups with pruning recommendations for each.

Grape varieties that produce seedlings of superior merit, R. Wellington (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 37–40*).—In this contribution from the New York State Experiment Station, presenting a tabular summary of the results of grape-breeding investigations, attention is directed to the fact that in general crosses between varieties have yielded a greater number of desirable seedlings than have selfed varieties. Governor Ross×Mills, Mills× (Winchell× Diamond), Triumph×Mills, and Winchell×Diamond have proved to be satisfactory crosses. The author states that plant breeders must depend upon *Vitis vinifera* species or derivatives of this species for quality and *V. labrusca, V. vulpina,* and other American species for hardiness.

The banana, its cultivation, distribution, and commercial uses, W. Fawcett (*London: Duckworth and Co., 1921, 2. ed., enl., pp. XI+299, pls. 8, figs. 10*).—An enlarged edition of the work previously noted (E. S. R., 30, p. 741).

Cultivation of the banana in Porto Rico, P. González Ríos (*Porto Rico Dept. Agr. and Labor Sta. Bul. 25 (1920), Spanish ed., pp. 3–30, figs. 10*).—A compilation of information relating to the banana, including history, botany, climatic factors, preparation of soil, selection of stocks, planting, cultivation, fertilizers, harvesting, species and varieties, diseases, insects, manufacture of banana flour, and other uses.

The storage and curing of mandarin oranges at the Batangas Commercial Citrus Station, J. de Leon (*Philippine Agr. Rev., 13 (1920), No. 3, pp. 214–216, pls. 2*).—Mandarin oranges placed in an underground storage chamber were found to assume a deep orange color and to improve in flavor and general quality. Hand-picked fruits were found to keep better than those clipped off with shears. In comparing open air, open shed, and underground storage more rot was observed in the last, but the extra loss was offset by the improved quality of the sound fruits.

Hardy border flowers, edited by H. H. Thomas (*London and New York: Cassell & Co., Ltd., pp. [VIII]+144, figs. 75*).—A small handbook of practical directions for planning, planting, and maintaining hardy borders.

Antirrhinums and Pentstemons, A. J. Macself (*London: Country Life; New York: Charles Scribner's Sons, 1921, pp. 32*).—A practical booklet on culture and propagation.

Rose gardening, M. Hampden (*London: Thornton Butterworth, Ltd., 1921, pp. 231, pls. 8, figs. 52*).—A treatise on the rose with particular reference to culture, varieties, propagation, and proper utilization. Sixteen varieties are illustrated in colors.

FORESTRY.

Growth of oak in the Ozarks, F. Dunlap (*Missouri Sta. Research Bul. 41 (1921), pp. 3–28, figs. 7*).—In this silvicultural study, conducted at Midco, Mo., measurements were made of the comparative rate of growth of four oak species, *Quercus alba*, *Q. marilandica*, *Q. minor*, and *Q. velutina*, known respectively as white, black jack, post, and black oaks, and deemed the most important species of the Ozark region. The methods employed in making the actual measurements have been previously noted (E. S. R., 41, p. 840).

The data, shown in tabular form and accompanied by geographical illustrations, indicate in part that black oak grows much more rapidly than white oak during the initial 100-year period. Post and black jack oaks were found to grow so slowly that the author concludes that they have no place in future silvicultural operations in the Ozark. A comparison of the rate of growth of Missouri white and black oaks with that of the same species growing in Kentucky and Tennessee indicated that the white oak grows more slowly and the black oak more rapidly under Missouri conditions.

A white fir volume table, D. Bruce (*California Sta. Bul. 329 (1921), pp. 41–45*).—Three volume tables, differentiated according to the log content of the tallest 10 per cent of the merchantable trees, are presented for white fir (*Abies concolor*). The author emphasizes the fact that trees of the same diameter and height may vary widely in volume and therefore not conform with the tabular value. However, in averages of many trees and for large groups such discrepancies tend to counteract one another or disappear altogether. A deduction in net volume from 15 to 35 per cent should be allowed for cull due to rots, breakage, and unused material in tops and stumps.

How tree seed is gathered, A. H. Richardson (*Canad. Forestry Mag., 17 (1921), No. 1, pp. 30–32, figs. 2*).—Information is given relative to the collecting and storing of balsam, white pine, red pine, and hemlock seed.

Some data on the bark renewal of Hevea brasiliensis, W. Bobilioff (*Arch. Rubbercult. Nederland. Indië, 4 (1920), No. 5, pp. 239–248*).—A brief account, with English summary, concerning the bark renewal of *H. brasiliensis* following tapping. It was found that the laticiferous vessels began to be renewed after six months, and that after a year the number had nearly reached that of the original bark.

Investigations concerning the starch of Hevea brasiliensis, W. Bobilioff (*Arch. Rubbercult. Nederland. Indië, 4 (1920), No. 3, pp. 71–121, pl. 1, figs. 6*).—An investigation, with an English summary, relating to the amount, disposition, and movement of starch in Hevea.

The author found that the cortex as well as the wood is well adapted to the storage of starch, which constitutes the principal reserve food of the plant. It was also noted that in case of interruption in the natural passages of the cortex the starch was carried by diffusion through the cell walls to the deficient location. As a practical deduction, he concludes that owing to the extensive quantity of starch stored in the Hevea tree and by reason of the diffusive movement of this substance, there need be no fear of a lack of starch being caused in trees by tapping.

Concerning the origin of latex as revealed by experiments with girdled trees, W. Bobilioff (*Arch. Rubbercult. Nederland. Indië, 4 (1920), No. 5, pp. 221–238, pls. 9*).—This paper presents further information (E. S. R., 42, p. 144) relative to the source of latex, in this instance as indicated by experiments with girdled trees. Girdling low down on the trunk temporarily decreased the yield of latex, but was followed by an increase. Girdling high up on the trunk decreased yield, and a combination of both high and low girdling was followed by a still greater decrease. Pollarding or pruning off the top of the tree caused an even larger decrease in yield. The author concludes that the increase in latex following low girdling proves that the trunk of the tree is the main source of latex, and believes that in budded trees the stock will have no direct influence on the yield of latex.

Latex and rubber from individual trees, I, II, O. de Vries (*Arch. Rubbercult. Nederland. Indië, 4 (1920), Nos. 5, pp. 249–271; 8, pp. 361–382*).—The first paper outlines methods employed in an investigation of the quality and amount of latex and rubber from individual trees. It was found that the yield varied from 4 to 71 gm., the rubber content of the latex from 17 to 50 per cent, the time of cure of the crepe from 90 to 160 minutes, and the viscosity from 14 to 90, thus indicating that marked variability exists between individual trees.

The second paper, dealing with factors that cause a change in the properties of the latex, points out that in order to obtain strictly comparable data the style of tapping should be uniform. Furthermore the quality of latex from a single tree was found to vary sharply at different seasons.

The land we live in, R. Black (*Canad. Forestry Mag., 17 (1921), No. 1, pp. 23–30, figs. 4*).—A statement of the forest resources and activities of the different Provinces of Canada.

Why the prairies are treeless, R. H. Campbell (*Canad. Forestry Mag., 17 (1921), No. 1, pp. 5–8, figs. 2*).—After analyzing several possible causes, including the nature of the soil, lack of sufficient moisture, occurrence of warm "Chinook" winds, and fire, the author believes that fire, following the interruption of the moisture laden winds by the uplift of the Rocky Mountains, was the immediate cause of the treelessness of the prairies.

Statement relating to the Union of South Africa (*Pretoria: Govt., 1920, pp. 28*).—A statement of the forest resources and activities of the Union of South Africa, prepared for the British Empire Forestry Conference held at London in 1920.

China pays the price of ruined forests, B. WILLIS (*Canad. Forestry Mag., 17 (1921), No. 1, pp. 17–20, figs. 4*).—The author, describing the completeness with which the Chinese have destroyed their accessible forests even to the mountain tops, emphasizes the consequent suffering from lack of moisture, food, and fuel. Terracing the hillsides has prevented some of the soil from being swept away by erosion, and has saved the land from utter destruction.

New forest law, W. A. L. BAZELEY (*Mass. Comn. Conserv. and State Forester Ann. Rpt., 1920, pp. 15–17*).—The text of the Massachusetts forest act, approved June 4, 1920, providing for the purchase and development of State forests, is given in full. As a result of the passage of the act, 5,339 acres, in five separate tracts, were purchased during the year, as well as additions to the older State forests. The new forests are briefly described.

Report of the State forester [New Jersey], A. GASKILL (*N. J. Dept. Conserv. and Development, Ann. Rpt., 1920, pp. 79–90, pls. 3*).—A review of the activities of the division of forestry in assisting private owners in reforestation and thinning and in the management of the State forests. A statement of the location and area of the State forests is included.

Report of the State firewarden [New Jersey], C. P. WILBER (*N. J. Dept. Conserv. and Development, Ann. Rpt., 1920, pp. 91–111, pls. 3*).—A record is given of the number of forest fires, their location, and the resulting loss during the calendar year 1919. The work of the division is reviewed, with particular reference to the extension of the lookout service.

Fourteenth annual report of the commissioner of forestry, J. B. MOWRY (*R. I. Commr. Forestry, Ann. Rpt., 14 (1920), pp. 10*).—A report for the calendar year 1920, emphasizing the need of a constructive forestry policy, which should provide for the creation of State forests and for greater private activity. The reforestation of the denuded chestnut lands is urged, with suggestions regarding the suitability of red pine and black oak for this purpose. By stump analyses the author found that 65 years were ordinarily required for the black oak to attain a diameter of 16 in. at 1 ft. height. In a moist favorable environment this diameter was reached in 45 years.

Reports on the forestry service [for the years 1917–18 and 1918–19], G. C. PICHÉ (*Quebec Min. Lands and Forests Rpts., 1918, pp. 23–67; 1919, pp. 23–57*).—These are progress reports on the administration and management of the crown forests of Quebec, including summaries of activities along the line of reforestation, nursery work, forest education, and technical studies. Data relative to work done in connection with the white pine blister rust, timber cut, and revenues, and special reports on forest fire protection are appended.

New Zealand Forestry Department report for the year ended March 31, 1920, E. P. TURNER ET AL. (*New Zeal. Forestry Dept. Rpt. 1920, pp. 36*).—A report of activities for the year ended March 31, 1920, similar to that for the preceding period (E. S. R., 43, p. 542).

DISEASES OF PLANTS.

Immunity of plants to infectious diseases, N. VAVILOV (*Immunitet Rastenii k Infektsionnym Zabolievaniiam. Moscow, 1919, pp. 239+3, pls. 5, figs. 3; reprint from Izv. Petrovsk. Selsk. Khoz. Akad., 1918*).—This exposition of data bearing upon immunity of plants to diseases includes, in the summary (English), a discussion of natural or acquired immunity of plants to disease; the extension of the phenomena of immunity among higher plants; the nature of immunity in plants; immunity and environment; laws of distribution of immunity among varieties of plants; immunity as a physiological test in genetics and systematics; hybridization of immune and susceptible varieties; and selection of immune

varieties and its limitation. A biblography is given including more than 200 titles.

The influence of soil factors on disease resistance, A. HOWARD (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 373–389, figs. 5*).—The various diseases referred to in this paper are considered to justify detailed investigation of the root systems of plants, combined with a consideration of the chief soil factors in connection with the study of disease.

On the fungus flora of glasshouse water supplies in relation to plant disease, W. F. BEWLEY and W. BUDDIN (*Ann. Appl. Biol., 8 (1921), No. 1, pp. 10–19, fig. 1*).—A severe epidemic of damping-off in tomato seedlings during the early part of 1919 was shown to be caused by a Phytophthora, possibly *P. cryptogea*, carried in the water supply. Later a severe attack of buckeye rot (*P. parasitica*) was traced to a like origin. The water was obtained from a well or other source and then piped from a tank 25 or 30 ft. above the ground. Systematic study shows that some nursery waters in the Lea Valley (England) constitute an important source of plant disease, also that such waters may be rendered safe by heat, filtering, or chemical treatment.

Division of botany, E. S. ARCHIBALD (*Canada Expt. Farms Rpt. 1920, pp. 58–63*).—A report is given by the acting botanist on the white pine blister rust and the work carried on at the several field laboratories in Ontario. Surveys of woodland areas in the Niagara peninsula showed that about 2 per cent of the pine trees were infected with blister rust, but that no increase in the number of diseased trees was found in 1919 over the number reported in the previous year.

At the St. Catherines field laboratory, a survey was made of the brown rot of stone fruits in which it was found that orchards not plowed were a more abundant source of apothecial inoculating material than either spring plowed or fall plowed orchards. Blossom injury was found to range from 4 to 73 per cent for peaches, 0.4 to 95 per cent for cherries, and from 0 to 94 per cent for plums. The amount of injury occasioned by brown rot at the time of maturity of the fruit was determined in 46 orchards and was found to vary from 1.2 to 9.5 per cent. In an attempt to control raspberry leaf curl infected bushes were removed from several plantations, but this did not seem to prevent the spread of the trouble.

At the Charlottetown laboratory, P. E. I., particular attention was given to potato diseases. The season was particularly favorable to the spread of late blight, and it was found that five sprayings were necessary to control the disease instead of four as formerly recommended. Some experiments were conducted on leaf roll and mosaic of potatoes which seemed to indicate that climatic conditions have considerable influence in determining the amount of disease present. It was also reported that diseased seed originally grown at Charlottetown developed little or no symptoms of mosaic when planted at Brandon and Indian Head, but that when the seed was returned to Charlottetown the disease was found as virulent as before.

Spraying experiments on 20 farms in Prince Edward Island for the control of potato rot showed that an increased yield as well as a sound crop resulted from thorough applications of fungicides.

At the Fredericton laboratory, N. B., attention was paid to potato and bean diseases, as well as to some investigations on grain diseases. Spraying experiments in which five or more applications were given the potato plant resulted in the reduction of rot and increased the yield.

Seed selection, seed treatment, spraying, and resistant varieties were all tested in bean anthracnose, and while complete control was not secured,

selected and treated seed developed less disease than untreated ones. Spraying proved of considerable value for bean anthracnose, but did not give absolute protection. Resistance of different varieties was tested and one variety, which was practically free from disease the previous year, developed considerable anthracnose. Studies were made of the presence of bean mosaic in commercial beans for seed purposes, the extent to which it is hereditary, and its nature and methods of spreading. The commercial stock was found to contain considerable quantities of mosaic-infected seed, some lots developing as high as 23 per cent of diseased plants. The investigations are believed to show that the disease is inherited, and it was found possible to transmit it to healthy plants either by hypodermic injections with extracts from diseased leaves or by pressing the leaves of healthy plants between the fingers moistened with the extract from infected leaves.

On the grain disease investigations in western Canada, the author reports the presence of smut of western rye grass, which is considered to be a seedling infection and is readily controlled by seed treatment with a solution of formaldehyde. In testing injury to grains caused by seed treatment, the results obtained showed no injury from the solutions of formaldehyde commonly used.

Some attention has been given to the study of the overwintering and origin of spring infection of the stem rust. It was found that summer spores of this rust may survive the winter on grasses, and that possibly spring infection may arise from these spores.

Diseases affecting field tests [in Holland], W. B. L. VERHOEVEN (*Verslag. en Meded. Phytopath. Dienst Wageningen, No. 11 (1920), pp. 12, pls. 3; also in Tijdschr. Plantenziekten, 26 (1920), No. 6, pp. 149–160, pls. 3*).—This deals chiefly with diseases of the common grains and legumes.

Vegetable pathology, [Queensland], H. TRYON ([*Queensland*] *Dept. Agr. and Stock, Ann. Rpt., 1918–19, pp. 45–49*).—Diseases of agricultural crops considered include maize cob rot (*Dothiorella zeae* or related organism) and smut (*Sorosporium reilianum*); cow cane rot; Sudan grass smut (*Cintractia sorghivulgaris*); broom millet red disease (bacterial?); alfalfa stem rot (*Rhizoctonia* sp. (*violacea*?), leaf rust (*Uromyces striatus*), and death due to overcropping; pea stem rot (*Corticium vagum*?); potato tuber brown rot (*Bacillus solanacearum*), brown fleck or sprain (physiological), internal darkening (physiological), stem rot (*Rhizoctonia* sp.), scab (grubs), and a decay (faulty seed); tomato root gall (*Heterodera radicicola*), bacterial sleeping sickness (*B. solanacearum*), Fusarium sleeping sickness (*F. solani*), blight (*Phytophthora infestans*), blossom end rot (bacterial), and leaf spot (*Septoria lycopersici*); crucifer bacterial disease (*Pseudomonas campestris*), downy mildew (*Peronospora parasitica*), cabbage seedling failure (*P. parasitica* or root poisoning), and turnip root galls (*Plasmodiophora brassicae*); cucurbit powdery mildew (*Erysiphe cichoracearum*), pumpkin sleeping sickness (*F. cucurbitae*), watermelon stem disease (*Colletotrichum oligochaeti*), and cucumber root gall (nematodes); beet nematode root gall (*H. radicicola*); bean rust (*U. appendiculatus*), root gall (*H. radicicola*), and Tonga bean leaf failure (toxic soil); cotton boll cast (climatic); citraceous scab (*Ramularia citri*), *bark disease* (*Corticium* sp.), exanthema (physiological), sterility, fruit drop (drought), green mold (*Penicillium glaucum*), black spot (*Phyllosticta citricola*), orange brown rot (*Pythiacystis citrophthora*), and die-back with gummosis; apple young wood disease (*Sphaeropsis malorum*), bitter pit, and pear internal decay; plum sun scald, apricot die-back, peach abnormalities, and nectarine bark (nonparasitic) fungus (*Polyporus* (*Trametes*) *cinnabarinus*); persimmon bark canker; custard apple die-back (soil conditions); papaya fruit disease (*Gloeosporium sp.*);

date leaf disease (*Graphiola phoenicis*); grape leaf sun scald; banana root disease (*Fusarium* sp.), root gall (*H. radicicola*), cabbage disease (undetermined), fruit end rot (meteorological and *Gloeosporium* spp.), and other fruit rots; pineapple fruit rot (*Thielavia* sp.) and root injury (soil irritants); rose root tumors; chrysanthemum leaf disease; sweet pea stem rot; and forest hardwood tree rots (Fomes or Trametes).

[Plant diseases and enemies, Bengal] (*Bengal Dept. Agr. Rpt. 1919–20, pp. 6, 7, 13; App. V, p. II*).—Jute black band disease (*Diplodia corchori*) does not seriously attack young jute or crops sown late, though crops sown early and kept for seed are more apt to suffer from this disease while the seed is maturing. Crops intended for fiber production suffer little. The fungus is now known to be widespread, outbreaks therefrom being presumably associated with chemical conditions in the soil.

Ufra can probably be eliminated from an affected area by early destruction of the stubble and cultivation of the land.

A chili disease, identified as *Vermicularia capsici* and accompanied by *Colletotrichum* sp., was reported from two districts.

Fungus diseases [of plants in Ceylon], T. Petch (*Ceylon Admin. Rpts. Sect. IV, Rpt. Dir. Agr., 1919, pp. 5–7*).—Brief notes are given regarding Hevea brown bast, root diseases (*Fomes lignosus, F. lamaoensis*, and *Xylaria* sp.), Phytophthora attack (*P. faberi* and *P. meadii*), leaf disease (*Oïdium* sp.), and a new phase of die-back associated with *Kretzschmaria micropus*.

Tea red rust was prevalent. A Rosellinia disease differed from that due to *R. arcuata*. Cases were observed of root disease (*Poria hypobrunnea*). The principal new tea disease is caused by *Cercosporella theae*, which attacks also *Acacia decurrens*.

Coconut showed no improvement as regards nut drop. The Phytophthora found in this connection may prove to be identical with *P. faberi*. A coconut disease characterized by a tapering of the crown may be due to *F. lucidus*.

Mycology, [India], S. L. Ajrekar (*Bombay Dept. Agr. Ann. Rpt., 1917–18, p. 77*).—This portion of the report includes brief notes on the sugary disease of durra due to *Sphacelia* sp., the green or false smut of rice, and storage rots of potato.

A Botrytis disease of currant and rhubarb, J. Leendertz (*Tijdschr. Plantenziekten, 26 (1920), No. 7, pp. 173–175*).—Notes are given of a Botrytis disease of currant and rhubarb, with suggestions regarding treatment and varietal resistance.

Fire blight: Bacteriological history in New Zealand, R. Waters (*New Zeal. Jour. Agr., 22 (1921), No. 3, pp. 143–145; abs. in Abs. Bact., 5 (1921), No. 5, p. 176*).—Soon after the presence of fire blight (*Bacillus amylovorus*) was suspected in the Auckland Province (late in 1919) work looking to specific identification of the organism was begun. This paper gives a brief account of the progress and result of these investigations. The most virulent strain was obtained from medlar, not previously recognized as a host of this organism.

Mosaic diseases of plants, E. M. Wakefield (*West Indian Bul., 18 (1921), No. 4, pp. 197–206*).—A review is given of theories and possibilities as to the modes of causation of diseases in plants, with special reference to sugar cane mosaic as typical of mosaic diseases. These are discussed as to the ultimate nature of the agencies causing these and diseases supposedly similar or related.

So far as experimentation is reviewed, no unquestioned means of producing mosaic disease in a healthy plant, except infection, has been ascertained. No property of the virus yet known is entirely inconsistent with the theory of organic causation. The persistent and indefinite increase with retention of prop-

erties after extreme dilution points to the presence of a living organism rather than of a chemical substance. Temperature relations point in the same direction. The discovery of a possible symplastic stage in bacteria, and of the formation of filterable gonidia which may produce new bacteria directly or after having entered the symplastic stage, appears to increase the possibility that eventually many of the infectious filterable viruses may prove to contain living organisms.

Specialized forms of Ustilago violacea, H. ZILLIG (*Centbl. Bakt. [etc.], 2. Abt., 53 (1921), No. 1–3, pp. 33–74*).—*U. violacea* appears to extend through practically all regions of the world excepting Australia, infecting about 70 species of Caryophyllaceae, and showing specialization in case of certain hosts. This discussion includes the physiological influences affecting *U. violacea* and its relations with host plants.

Some methods for investigating internal seed infection, J. B. S. NORTON and C. C. CHEN (*Phytopathology, 10 (1920), No. 8, pp. 399, 400*).—The authors describe a method which they have developed for studying internal seed infection. Seeds are first soaked in water from 10 to 12 hours, shaken for 3 to 5 minutes in an alcoholic solution of corrosive sublimate, removed from the solution and washed once in ethyl alcohol and then three times in sterile water, removed with sterile forceps, and planted in sterile nutrient agar plates for germination.

Internal fungus parasites of agricultural seeds, C. C. CHEN (*Maryland Sta. Bul. 240 (1920), pp. 81–110, figs. 22*).—A study was made of agricultural seed collected from both diseased and healthy plants to determine the occurrence of internal fungus parasites. The seeds were treated as described above.

The author isolated from sterilized asparagus seed a species of Cylindrophora; from cabbage, *Alternaria* sp.; from common beans, species of Fusarium, Macrosporium, and Alternaria; from cowpeas, a species of Macrosporium; from lima beans, species of Fusarium; and from soy beans, species of Macrosporium and Fusarium. A fungus parasite of sweet corn seedlings was observed that appeared to be identical with *Oospora verticillioides*. A sterile fungus was noted as a parasite of wheat seedlings. *Rhizopus nigricans* was isolated from dark colored seeds of rotten tomato. The mosaic disease of tomato was not found to be transmitted through the seed. Tests of barley, alfalfa, timothy, red clover, and crimson clover were made, but no pathogens found.

For the control of internal fungus parasites of seeds, the author recommends seed selection from disease-free plants, the germination test, and hot water and hot air treatment of seeds.

Grass rusts of the Andes, J. C. ARTHUR (*Abs. in Science, n. ser., 54 (1921), No. 1397, p. 337*).—The results are given of a study of grass rusts collected by Mr. and Mrs. Holway in the Andes. Prior to the present investigation barely a score of forms of rust had been reported from this region, but from the material examined the number of species has increased more than double, several of the forms being new to science.

Lyer disease of maize, B. PALM (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 32 (1918), pp. 78, pls. 8*).—The symptoms of three types of lyer disease of maize are outlined. The trouble is said to be caused by a fungus which is here named *Sclerospora javanica*, though given as synonymous with *Peronospora maydis*, as noted by Raciborski (E. S. R., 10, p. 56) and by Rutgers (E. S. R., 37, p. 552), also as synonymous with *S. maydis*, as noted by Butler (E. S. R., 31, p. 51). It is explicitly stated, however, that the Java corn lyer fungus is not identical with the corn Sclerospora from British India described by Butler, whose naming of the fungus dealt with by him is approved.

Studies made on the Java organism are indicated, the principal conclusions from which are to the effect that there is no danger in planting infected seed, as seed material from a diseased crop does not carry the disease. The incubation period is usually from 10 to 20 and sometimes 30 days. The liability of *Zea mays* to infection is considerable while in the seedling stage and increases until three or four leaves are present, after which it diminishes so that a plant three weeks old is probably not susceptible. A new aspect is given to the question of control by establishment of the fact that the disease is propagated only through the conidial fructification.

Maize smut, E. NOFFRAY (*Jour. Agr. Prat., n. ser., 34 (1920), No. 46, p. 394*).—Further observations on maize smut (E. S. R., 45, p. 50) are noted, with outline of control measures suggested, including rotation, seed treatment, field inspection late in July, and removal of diseased plants.

Wheat foot rot disease, L. E. MELCHERS (*Amer. Elevator and Grain Trade, 40 (1921), No. 2, p. 113*).—A foot rot of wheat resembling the Australian take-all was brought to notice in Kansas in 1920, and when searched for in 1921 appeared to be confined almost entirely to Dickinson County, Riley and Saline showing one case each. The disease is briefly described. It appears to live over in the soil and spread in successive years. The only recommendations offered are precautionary.

Wheat glume rust, DENAIFFE and SIRODOT (*Jour. Agr. Prat., n. ser., 34 (1920), No. 37, pp. 212–214, figs. 2*).—Observations to be continued on wheat glume rust support thus far the view that this rust is due to *Puccinia rubigovera* and not to *P. graminis.*

Breeding wheat to resist rust (*Northwest. Miller, 126 (1921), No. 3, p. 296*).—Addresses were delivered by W. P. Thompson and W. P. Fraser at the agricultural conference held at Saskatoon, Sask., in April, 1921, on the subjects of breeding wheat for rust resistance and plant disease investigation in Saskatchewan.

It is stated that tests conducted repeatedly for a long time in field and greenhouse revealed true rust resistance in less than a dozen wheat varieties. Nearly all of these had little value for commercial purposes. No consistently resistant bread wheat was included. Crossing experiments showed that though resistance was transmitted in crosses (appearing in a portion of F_2), the inheritance is not of the Mendelian type (3 : 1) (as is said to be the case with European wheat rust), at least eight out of nine of the F_2 plants being wholly susceptible. However, resistance presented by a few of the hybrids was combined with many of the good qualities of the standard parent variety. Breeding work with these has produced hybrids presenting resistance combined with other desirable qualities, but some of these after resisting for several generations suddenly appeared susceptible. This has since been shown to have been due to the development of different strains of rust.

Fraser, reporting on plant diseases, states that most of the laboratory work referred to has been on wheat stem rust. The summer spores of stem rust have been proved to overwinter on grasses, but it has not been shown that this is the usual source and method of the spring infection. The rust appears first on wheat and thereafter spreads to the grasses. Rust appears usually over a considerable area about the same time, with the same degree of infection, which suggests that infection comes through wind-blown spores from the south. Rust was always noticed first in southern Manitoba and southeastern Saskatchewan, appearing later farther west and north. Greenhouse experiments are in progress to determine the number of rust strains, their prevalence, and their distribution in Canada. Eight strains have been isolated in

Canada, and there is evidence of more. It has also been shown that the strain which can not infect Kanred and white spring emmer, but readily infects the other varieties used, is the most widely distributed, most prevalent, and earliest in Canada. The line of research that appears most promising is breeding for rust resistance. Work of this kind is now being carried on at the University of Saskatchewan by Thompson.

Seed disinfection trials against wheat stinking smut, C. VAN DEN BERG (*Verslag. en Meded. Phytopath. Dienst Wageningen, No. 18 (1921), pp. 18–30; also in Tijdschr. Plantenziekten, 27 (1921), No. 2, pp. 17–19*).—Tests outlined show that proper seed grain treatment gives good financial returns, much better results having been obtained from copper sulphate than from Uspulun.

New [plant] diseases, T. A. C. SCHOEVERS (*Tijdschr. Plantenziekten, 26 (1920), No. 11, pp. 208–211*).—In 1920 attention was called to a bean-spotting disease, a study of which with an associated fungus suggests the agency of *Isariopsis griseola.*

Cucumber disease investigations, S. P. DOOLITTLE (*Canner, 52 (1921), No. 10, II, pp. 209–212*).—In the present discussion (E. S. R., 44, p. 344) of two years' work in the middle Western States, it is claimed that white pickle or cucumber mosaic is by far the most serious disease affecting the cucumber in that section and that it is equally serious in the Eastern States. This trouble is not due to weather nor is it preventable by soil management. The virus, introduced into a wound on a healthy plant, will reproduce the disease, Insects, in particular cucumber aphis and the striped beetle, are among the most important agents in its transmission, though it is also spread by the hands in picking.

This disease was much worse in 1920 than in the previous year, owing to the fact that the weather was more favorable to the reproduction of plant lice. The disease never overwinters in the soil and very rarely in the seed of the cultivated cucumber, but it survives in the seed of the common wild cucumber, which is regarded as one of the most important agents for its dissemination in certain districts. Removal of wild cucumber from certain areas resulted in almost complete freedom from mosaic disease. Other plants besides those of the cucumber group are attacked, and it has been found recently that a perennial species of the milkweed carries the disease over winter in its roots.

Potato experiments [in New Zealand], H. M. NICHOLLS (*Tasmania Agr. and Stock Dept. Rpt. 1919–20, pp. 23–25*).—Experiments at Scottsdale, continued since 1918 for the purpose of testing the effects of heat in destroying diseases in seed potatoes, are described as carried out with a simple but sufficient appliance. The seed potatoes were kept at 125° F. during the four hours. The effects as regards control of various diseases were made apparent in several ways from the first appearance of the young plants above ground. The crop was clean and excellent with very few exceptions.

Transmission of some wilt diseases in seed potatoes, M. B. MCKAY (*Jour. Agr. Research [U. S.], 21 (1921), No. 11, pp. 821–848, pls. 3, figs. 8*).—In a contribution from the Oregon Experiment Station, the author reports upon investigations conducted to determine the importance of wilt diseases of potatoes in Oregon and the extent to which the fungi causing them are transmitted from year to year in seed potatoes. The studies were conducted in western Oregon, and the results are said to apply to western Oregon conditions.

Verticillium alboatrum is reported to be more important than *Fusarium oxysporum* as a cause of wilt of potato plants. *F. radicicola* also is often present in the same region, but it is not known to be a cause of the wilt of the plants.

In addition to these three fungi there are several others that invade the stem-end region of potato tubers, and the longer the potatoes are kept in storage the larger is the number of tubers which yield organisms in cultures. The presence of discoloration in the stem-end vascular region of potatoes was found not to be a trustworthy index of the presence of disease-producing organisms, and the author claims that it should not be relied upon exclusively as a guide for the separation of diseased from healthy tubers for planting purposes.

V. alboatrum was found to be transmitted to a considerable extent from seed potatoes to yields, from 30 to 50 per cent of the tubers grown from known infected seed potatoes being invaded by this organism when harvested and cultured. *F. radicicola* and *F. oxysporum* were transmitted to only a slight extent from seed potatoes to yields, and were apparently not infrequently present in soils which had not been planted to potatoes for several years.

The stem-end seed pieces did not appear to give more disease either in the plants or in the tubers produced from them than the eye-end seed pieces of the same infected tubers.

A stem-end rot of potato tubers, varying from a mere wilting of the stem end to a dry, withered, brown to black rot, or to a soft, jellylike, light-brown rot, is reported as being rather common during some seasons in western Oregon. It is believed to be due as much to climatic conditions during the growing season as to the presence of any certain parasitic organism.

Potato tuber diseases, T. A. C. Schoevers (*Meded. Phytopath. Dienst Wageningen, No. 9 (1919), pp. [16], pls. 3; also in Tijdschr. Plantenziekten, 26 (1920), No. 1, pp. 5–20, pls. 3*).—Descriptions are given of potato tuber diseases known or suspected to exist in the region connected with the Phytopathological Service at Wageningen.

Potato black wart, S. Mottet (*Jour. Agr. Prat., n. ser., 32 (1919), Nos. 37, pp. 749–751, figs. 2; 38, pp. 767–768, fig. 1*).—An account is given, chiefly from English sources, of the biology and practical bearings of potato black wart (*Synchytrium endobioticum* (*Chrysophlyctis endobiotica*)), and of preventive measures. Several varieties are listed as being immune.

Potato leaf roll, J. G. O. Botjes (*De Bladrolziekte van de Aardappelplant. Proefschr. Landb. Hoogesch., Wageningen, 1920, pp. VIII+136, pls. 8, fig. 1*).—A dissertation, with briefer presentation in German, summarizes the primary and secondary characters involved in the appearance and progress of leaf roll, the cause of which remains unknown. The trouble is transmissible during the growth period. Insects appear to be able to carry the infecting material.

Spraying to increase potato production, G. Maheux (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 12 (1919–20), pp. 43–46*).—Increase of potato acreage and average acre yield, which are presented in tabular form, appear to be results of the increasing and successful use of protective measures.

Rice root rot, B. T. Palm and S. C. J. Jochems (*Deli-Proefsta. Medan Vlugschr., 3 (1920), pp. 4, figs. 4*).—A paddy root rot in Java is briefly described, the direct cause of which appears to be a lack of oxygen in the soil. Suggestions for avoidance of this condition are offered.

Beet nematode in Utah (*Facts About Sugar, 13 (1921), No. 4, p. 72*).—It is said that the sugar beet nematode has become quite widely distributed through the chief beet growing counties of Utah, and is increasing the area of infestation each year. Crop rotation appears to be the only method of combating this pest. Such rotation should include a leguminous crop, such as alfalfa, clover, peas, or beans. If alfalfa is grown, a crop of wheat or corn may follow before beets are planted.

Breeding mosaic-resistant spinach and notes on malnutrition, L. B Smith (*Virginia Truck Sta. Bul. 31–32 (1920), pp. 137–160, figs. 5*).—The author

reports spinach blight or mosaic as causing serious loss in the Virginia trucking region, and gives the results of experiments in the breeding of varieties resistant to this disease. Crosses were made between the commercial variety Savoy and a wild variety obtained from China. As a result of this, cross selections have been made and one resistant variety of good quality has been named Virginia Savoy. In 1920 this variety was affected with mosaic to the extent of about 0.64 per cent, while adjacent beds of commercial Savoy spinach showed the presence of mosaic amounting to 10.57 per cent. Seed of this variety is said to have been grown under contract for distribution.

Associated with the mosaic disease is a physiological trouble which closely resembles mosaic, although it is noninfectious. This trouble is said to be due to malnutrition, and its distinguishing features, aside from being noninfectious, are reddening and dwarfing of the plants and absence of mottling, the plant finally becoming wholly red or yellow. The roots are said to be dwarfed in proportion to the dwarfing of the plant as a whole.

Fungi and cane germination, C. W. EDGERTON and C. C. MORELAND (*Sugar [New York], 23 (1921), No. 1, pp. 16, 17, fig. 1*).—This very condensed account outlines the information given in the bulletin previously noted (E. S. R., 43, p. 348).

Leaf stripe disease of sugar cane in the Philippines, H. A. LEE and M. G. MEDALLA (*Science, n. ser., 54 (1921), No. 1395, pp. 274, 275*).—The authors report observing in April, 1921, among ratooned canes numerous cases of etiolation of the young plants, and on close examination the lower surface of the affected leaves showed the presence of a fungus which was apparently a species of Sclerospora. The cane had been grown from seed cane introduced from Formosa, and basing their opinion on the work of Weston (E. S. R., 43, p. 545), the authors believe that the fungus was *S. sacchari.*

Mosaic disease of sugar cane [and control measures] (*La. Planter, 66 (1921), No. 12, pp. 186, 187*).—Mosaic disease of sugar cane, though first recognized in the spring of 1920, is thought to have been present in the State for a number of years, having probably been introduced from the Tropics with some new cane variety. Regions of infection are indicated. A general tendency to spread is everywhere noticeable. The occurrence of secondary infection complicates control so far as selection of planting material is concerned, as this sort of infection is not always apparent externally. Varieties are discussed as to susceptibility.

Mosaic occurs on all classes of lands. Plans for reducing loss include use of seed stock known to be healthy, isolation of infected areas, and rogueing.

Tobacco diseases, F. CHARLAN (*Canada Expt. Farms Rpt. 1920, p. 40*).—As a result of experiments to control and eradicate the root rot in tobacco due to *Thielavia basicola*, the author found that disinfecting the soil of the seed beds, either by steam or formalin, and the adoption of rotations were the only methods which proved effective.

Continued observations of the mosaic disease of tobacco have indicated that certain varieties are especially subject to this disease, and it is thought that there is some indication of securing strains of tobacco resistant to this trouble.

In connection with root rot of tobacco, a resistant strain of White Burley which gave a yield equal to that of the ordinary type has been obtained as a result of crossing White Burley with a variety naturally resistant to the disease.

[Tomato diseases], G. ROVESTI (*Indus. Aliment. Ital., 2 (1920), No. 10, pp. 155–159, figs. 8*).—Tomato diseases here discussed include chiefly the effects of Peronospora, but also those of such other agencies as bacteria, Septoria, and

Alternaria, besides animal parasites, with some discussion of preventive or remedial measures.

A tomato canker, E. M. DOIDGE (*Ann. Appl. Biol., 7 (1921), No. 4, pp. 407–430, pl. 1, figs. 5*).—A tomato canker first noted in the Pretoria market in 1914, and found to occur in the market gardens of that district and elsewhere, is described in connection with studies indicating the cause to be an organism not previously recorded. This organism is described as a new species under the name *Bacterium vesicatorium.*

The disease is not very sensitive to the usual fungicides. Selection, sterilization, rotation, and sanitation are suggested.

Wastage of fresh fruits and vegetables in transit and in storage, F. C. MEIER (*Md. Agr. Soc. Rpt., 5 (1920), pp. 310–317, pls. 2*).—Estimates are tabulated of losses during 1918 due to diseases of the potato, bean, and sweet potato, with a discussion of causes and phases of loss to growers, shippers, and storers of these and other crops.

Primary infection from black spot, J. M. WARD and P. H. THOMAS (*Tasmania Agr. and Stock Dept. Bul. 85 (1920), pp. 1–7, figs. 3*).—A brief review is given of the general climatic conditions of the years 1916–1918 as compared with those of 1918–1919, in connection with infection of apple by black spot (*Venturia inaequalis*). This is followed by an account of studies bearing upon the proper times for applying sprays to minimize loss from disease and from spray injury.

Weather conditions are considered to play a very important part in the development of black spot. Up to the present time the best fungicidal results on the whole have been given by Bordeaux mixture.

The leaf spot fungus, H. M. NICHOLLS (*Tasmania Agr. and Stock Dept. Bul. 91 (1920), pp. 1–5, figs. 2*).—During the last few years the leaf spot disease (*Sphaeropsis malorum*) has attracted attention in fruit growing districts at both ends of the island of Tasmania, being particularly common in districts where imported apple trees have been largely planted. In Tasmania the orchards worst affected are those planted on poor, sandy land, deficient in humus, and subject to blowing. Discussion is given of local control methods recommended.

Root fungus [in apple orchards], J. M. WARD and P. H. THOMAS (*Tasmania Agr. and Stock Dept. Bul. 85 (1920), pp. 7–9*).—Areas cleared of brush for orchard planting, if the soil is not completely freed from roots and disinfected, are apt to show the presence of root disease (*Armillaria mellea*). Of the remedies tried, the dry lime, sulphur, and copper sulphate treatments gave no benefit in checking the spread of the disease. Iron sulphate definitely checked the disease. Bordeaux paste in one experiment appeared to have effected complete recovery.

Experimental spraying [of apple trees], E. W. WHITE (*Brit. Columbia Dept. Agr. Ann. Rpt., 14 (1919), pp. 16, 17*).—Tests at Keating, herein briefly described, show that even a weak Bordeaux mixture, if applied early, will give almost perfect control of apple anthracnose.

Story of blight, especially as it affects Oregon apples and pears, C. C. CATE (*Oreg. Grower, 2 (1921), No. 7, pp. 3, 7, 8, 9, 11, figs. 3*).—The history of pear and apple blight is sketched from its appearance in 1780, with an account of its transportation, mode of attack, and progress. The small-grain thrips is one of the most important carriers of blight in the Rogue River Valley.

The American pear blight [in New Zealand], H. M. NICHOLLS (*Tasmania Agr. and Stock Dept. Rpt. 1919–20, p. 22*).—The presence of pear blight, here designated as the most disastrous and difficult to control of all pear diseases,

was suspected in 1916 and admitted at the time of this report. Protective measures are discussed.

A new disease of peach in Liguria, G. Pollacci (*Atti R. Ist. Bot. Univ. Paiva, 2. ser., 17 (1920), pp. 203–208, pl. 1*).—A new disease attacking peach fruits in Liguria is associated with a Sporotrichum herein described as a new species under the name of *S. persicæ*.

The powdery mildew of the grape, I. B. P. Evans (*So. African Fruit Grower and Smallhold., 7 (1920), No. 12, p. 359, fig. 1*).—Grape powdery mildew (*Uncinula spiralis, Oïdium tuckeri*) is said to occur on grape vines throughout South Africa. Dusting with sulphur is the most effective remedy.

A mulberry disease, G. Briosi and R. Farneti (*Atti R. Ist. Bot. Univ. Pavia, 2. ser., 17 (1920), pp. 185–202, pls. 14*).—A threatening mulberry die-back affecting branchlets aged one, two, and more years is noted in connection with the presence of a Fusarium, the causal agency of which has not yet been established.

Citrus and pineapple fruit rots, J. Matz (*Porto Rico Dept. Agr. and Labor Sta. Bul. 24 (1920), pp. 3–12, figs. 3*).—Popular accounts are given of the stem-end rot and the blue mold of oranges, and of blue-mold decay, brown rot, and stem-end rot of pineapples. Some experiments are also briefly reported in which the author undertook to determine the influence of immersing oranges in bichlorid solutions before and after passing through the washing, drying, and sorting conveyors. It was found that fruit which was unwashed and unpolished was more liable to decay, and that sterilization of the surface of fruit before passing them through the conveyors did not result in an increase in decayed fruit as compared with the fruit sterilized after having passed through the conveyors.

The effect of packing on decay was noted, as well as the difference between clipped and pulled fruit. It was found that fruit without stems and calyxes were more susceptible to blue-mold decay, and that the amount of stem-end rot was proportional to the length of time the fruit was off the tree before packing. Sterilizing the fruit before packing, it was found, did not give satisfactory results.

For the control of pineapple rots, the author recommends leaving longer stems on the fruit and fumigating with formaldehyde gas.

Action of some fungicides on the citrus canker organism, H. A. Lee (*Philippine Jour. Sci., 17 (1920), No. 4, pp. 325–341; abs. in Abs. Bact., 5 (1921), No. 5, p. 176*).—It is stated that phenol at 1:100 kills a three-day culture of *Pseudomonas citri*, the cause of citrus canker, in 2.5 minutes. Mercuric chlorid will do the same at a dilution of 1:20,000, as will also formalin at 1:20. Lime sulphur (32° Baumé) requires a concentration of 1:1,000; copper sulphate, of 1:200. Neutral Bordeaux has no value, and Bordeaux at 4:4:50 but little, though at 4:6:50 this mixture kills in 2.5 minutes even when diluted with four parts of water. Slaked lime is effective at 1:1,000. Burgundy mixture at 3:4:50 has little effect even after longer exposures. Formalin is uneconomical, and perhaps usually without value. Copper precipitate sprays used against the citrus canker organism are said to be valueless without lime in excess. The toxicity of a spray containing lime in excess appears to depend upon the concentration of calcium hydroxid in the solution. A lime solution is suggested for field trials against *Pseudomonas citri*.

A disease of coconut [in St. Lucia] (*West Indies Imp. Dept. Agr., St. Lucia Agr. Dept. Rpt., 1918–19, pp. 7, 8*).—A threatening disease affecting coconut trees four or five years of age, supposedly due to a Pythium, appeared on an estate in the Dennery district.

Some plant diseases in the greenhouse, B. T. DICKSON (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 12 (1919–20), pp. 46–48, pls. 5*).—A brief account of plant diseases which were prominent during the autumn and winter of 1919–20 in the greenhouse at Macdonald College, Quebec, includes notes on carnation rust (*Uromyces caryophyllinus*); cineraria dwarfing, mosaic, and distortion; snapdragon rust (*Puccinia antirrhini*); sweet pea powdery mildew (*Microsphaera alni*); tomato mosaic, also a leaf mold (*Cladosporium fulvum*); and violet leaf spot (*Alternaria violae*).

Sweet pea bud drop, H. D. BROWN (*Amer. Florist, 56 (1921), No. 1707, p. 242*).—The results of sweet pea bud drop studies indicate that most of the drop is caused by insufficient light. Blossoms developed under artificial light on plants which had not previously produced blossoms. It is thought that the bud drop of sweet peas is related to the food which the plant obtains and the amount of light secured.

Combating nematodes in flower bulbs, E. VAN SLOGTEREN (*Tijdschr. Plantenziekten, 26 (1920), Nos. 5, pp. 118–138, pls. 2; 7, pp. 161–171, figs. 3; 8, pp. 177–185, pl. 1*).—The studies here in part reported were begun in 1917 on narcissus bulb nematode disease, ascribed to *Tylenchus devastatrix*, a strain thought to differ somewhat from the one attacking the hyacinth. The treatments discussed aim to attack the disease in the bulb, in the soil, and in both bulb and soil.

[Uspulun as protective against leaf nematodes], C. POSER (*Gartenwelt, 25 (1921), No. 22, pp. 217, 218, fig. 1*).—*Stenoglottis longifolia*, which had shown since 1912 reduced vitality and abnormality as regards blooming, was dipped in 1 per cent Uspulun in 1919 and in 1920 showed normal rosettes and good appearance generally. The untreated plants showed the brown stripes and wilting usual to nematodes, and these proved to be present in the sick specimens, having come through the winter in the smallest dried portions of the leaves.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The selection of family names in zoology, W. L. MCATEE (*Jour. Wash. Acad. Sci., 11 (1921), No. 10, pp. 230–235*).

What health officers can do to promote rat extermination, E. A. GOLDMAN (*Amer. Jour. Pub. Health, 11 (1921), No. 7, pp. 606–613, figs. 3*).—This paper outlines well-digested plans for efficient warfare on the rat.

A monograph of the pheasants, W. BEEBE (*London: H. F. & G. Witherby, 1918, vol. 1, pp. XLIX+198, pls. 41, fig. 1; 1921, vol. 2, pp. XV+269, pls. 53*).—The first of the four volumes which will comprise this work consists of an introduction, giving a brief general account of pheasants, their distribution, habits, and relation to man, followed by accounts of the species of the genera Ithagenes, Tragopan, Lophophorus, and Crossoptilon. The second volume deals with pheasants of the genera Gennaeus, Acomus, Lophura, Lobiophasis, and Gallus.

The monograph represents eight years of preparation, including 17 months spent in the study of the living pheasants in their natural environment in Eastern Asia and the East Indies. Nearly 100 species are systematically described, the birds being illustrated by colored plates by six leading American and English artists. The haunts of the pheasants are shown in a large number of photogravures reproduced from the author's photographs, ranging in scene from the slopes of the Himalayan snow peaks, 16,000 ft. above the sea, to the tropical seashores of Java. In addition to these are numerous maps showing the distribution of the birds, diagrams of feathers, and numerous other illus-

trations. Considerable space in volume 2 (pp. 172–212) is given to the red junglefowl (*Gallus gallus* L.), which represents the ancestor of our domestic fowl.

The work is published under the auspices of the New York Zoological Society.

Index II to the literature of American economic entomology, January 1, 1915, to December 31, 1919, compiled by M. COLCORD, edited by E. P. FELT (*Melrose Highlands, Mass.: Amer. Assoc. Econ. Ent., 1921, pp. (6)+388*).—This second index has followed closely the plan of the earlier Banks' index (E. S. R., 38, p. 256). The scope is limited to temperate and subtropical America, thus excluding the extreme north and the Hawaiian Islands. The questions of synonymy and nomenclature have been determined by members of the Bureau of Entomology, U. S. Department of Agriculture, and only the better established or well-known common names have been retained.

How to collect and preserve insects, F. E. LUTZ (*Amer. Mus. Nat. Hist. Guide Leaflet 39 (1920), pp. 22, figs. 12*).—A brief popular account.

Acquired immunity in insects, A. PAILLOT (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 9, pp. 278–280; abs. in Rev. Appl. Ent., 8 (1920), Ser. B, No. 5, pp. 86, 87*).—The author has observed cases of natural immunity in insects due exclusively to the action of antibodies of the blood. In the present case the caterpillars of *Agrotis* sp. were immunized against *Bacillus melolonthae nonliquefaciens*, which produces a fatal septicemia. This was accomplished through the administration of a culture two or three months old, followed in 24 hours, or even several days, with a further inoculation with a fresh culture.

Immunity in insects, A. PAILLOT (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 16, pp. 757–759, fig. 1*).—This is a brief discussion of the immunity reaction of insects to pathogenic coccobacilli, particularly *Bacillus melolonthae nonliquefaciens* β and γ, *B. pieris nonliquefaciens* α, and *B. bombycis nonliquefaciens* α.

Report of the division of entomology, F. N. WALLACE, H. F. DIETZ, ET AL. (*Yearbook State Ind. 1920, pp. 273–284*).—Included in this report is information on the occurrence of chinch bugs, the grape flea-beetle, oyster-shell scale, and Hessian fly, and means for their control.

Eighteenth report State entomologist of Minnesota, A. G. RUGGLES (*Minn. State Ent. Rpt., 18 (1920), pp. 210, figs. 55*).—This report includes the following papers: Observations on Mites Infesting Flour and Mill Feed, by R. N. Chapman (pp. 20–25); Factors Influencing the Subcortical Temperatures of Logs, by S. A. Graham (pp. 26–42); Studies of the Flight of Nocturnal Lepidoptera, by W. C. Cook (pp. 43–56); The Principles of Film-forming Sprays, by W. Moore (pp. 57–62); Contribution to the Knowledge of the Group Aphidina, Family Aphididae (Homoptera), by O. W. Oestlund (pp. 62–76); and Monograph of the North American Species of Deraeocoris (Heteroptera, Miridae), by H. H. Knight (pp. 77–210).

[Report of the] division of insect and plant disease control, S. B. FRACKER (*Wis. Dept. Agr. Bul. 33 (1920), pp. 103–163, figs. 35*).—The appearance of and control work with the more important insect pests of the year are considered; apiary inspection work, including maps showing the distribution of European foul brood and American foul brood in Wisconsin, is reported upon; and accounts are given of The European Corn Borer Survey, by H. K. Harley (pp. 139–144), of Diseases and Insect Injuries of Cane Fruits in Wisconsin, 1919, by L. K. Jones (pp. 149–157), etc.

Insect and arachnid pests of 1919, R. S. MacDougall (*Highland and Agr. Soc. Scot. Trans., 5. ser., 32 (1920), pp. 152–192, figs. 18*).—This presents information on the more important pests of the year 1919.

Some interesting economic insects recently observed in California, E. O. Essig (*Calif. Dept. Agr. Md. Bul., 10 (1921), No. 4, pp. 140–143, figs. 3*).—The species here noted are the Mexican bean weevil (*Spermophagus pectoralis* Sharp), the barnacle wax-scale, the dictyospermum or Spanish red scale (*Chrysomphalus dictyospermi* Morg.), several insects in shelled peanuts, and insects in copra.

[Insect pests in Barbados], J. R. Bovell (*Barbados Dept. Agr. Rpt., 1918–19, pp. 22–26*).—This reports upon the occurrence and work with the root borer (*Diaprepes abbreviatus* L.), the brown hardback (*Phytalus smithi* Arr.), and other insects attacking sugar-cane, cotton, etc. The loss occasioned by *D. abbreviatus* and *P. smithi* is on the increase, in some instances, having amounted during the year to 50 per cent. A high percentage of parasitism by *Tiphia parallela* was found. *Thrips tabaci* is said to have been the cause of a great deal of injury to fields of eschalots.

[Insect enemies of sorghum millet (mtama) in east Africa], H. Morstatt (*Arb. Biol. Reichsanst. Land u. Forstw., 10 (1920), No. 3, pp. 243–263*).—The more important insect pests of mtama are considered.

Caterpillar injury to tobacco cultivation on the east coast of Sumatra, E. Mjöberg (*Meded. Deli Proefsta. Medan, 2. ser., No. 15 (1920), pp. 54, figs. 11; abs. in Rev. Appl. Ent., 9 (1921), Ser. A, No. 2, pp. 85, 86*).—With the development of tobacco cultivation on the east coast of Sumatra, in which island it is now the principal crop, the leaf injury by insects has steadily increased. This is caused mainly by caterpillars, of which the bollworm *Prodenia litura* F., and *Phytometra* (*Plusia*) sp. are largely responsible, although on plantations at a higher altitude grasshoppers occur and are quite as harmful. Of the 90 per cent due to insect attack, 60 per cent occurs in the field and 30 per cent in the drying sheds.

Cherry insects and their control, A. L. Lovett (*Better Fruit, 15 (1921), No. 9, pp. 3, 4, figs. 4*).—A brief account of the more important cherry insects in Northwestern United States and means for their control.

Grasshopper control (*Mich. Agr. Col. Ext. Bul. 19 [1919], pp. 2*).—This consists of a discussion of the method of applying poison bait.

The white ant pest in northern Australia, G. Hill (*Aust. Inst. Sci. and Indus. Bul. 21 (1921), pp. 26, pls. 12*).—This consists of some preliminary observations on *Mastotermes darwiniensis* and other termites.

Poisoning grasshoppers, A. V. Mitchener (*Manitoba Agr. Col. Circ. 59 (1921), pp. 4, figs. 3*).—This circular gives a description and drawings of the so-called Manitoba grasshopper poison mixer, the formula of bait used, and directions for mixing and scattering.

The periodical cicada, or so-called 17-year locust, in West Virginia, 1919, W. E. Rumsey (*W. Va. Dept. Agr. Bien. Rpt., 4 (1919–20), pp. 60–67, figs. 12*).—This is a summary of information on the periodical cicada, calling attention to the fact that brood 10 would appear in great numbers in the eastern Panhandle section of West Virginia in 1919.

Solenopotes capillatus, a sucking louse of cattle not heretofore known in the United States, F. C. Bishopp (*Jour. Agr. Research [U. S.], 21 (1921), No. 11, pp. 797–801, figs. 6*).—The sucking louse *S. capillatus*, described from cattle in Germany by Enderlein in 1904, is recorded from the United States. Technical descriptions are given of the egg, nymphal, and adult stages. The

species is shown to occur over a wide area, having been recorded from Vermont, New York, Maryland, Texas, Oregon, and Washington.

A marked tendency toward attaching in dense groups about the head and neck of the host is shown. The incubation period is about 12 days, and the eggs apparently will not hatch when removed from the host. A number of eggs are frequently attached to a single hair, and may be found anywhere from the base to the tip of the hair. That it may at times become a serious pest is indicated.

An invasion of Deilephila lineata livornica Esp. in Provence, J. COTTE (*Soc. Path. Veg. France, Bul., 7 (1920), No. 3, pp. 76–79*).—The author records serious injury by the caterpillar of this sphinx moth in two vineyards under observation, one at La Môle and the other at Lamanon.

The army worm, W. P. FLINT (*Ill. Dept. Registr. and Ed., Div. Nat. Hist. Survey, Ent. Ser. Circ. 7 (1920), pp. 9, figs. 4*).—This is a popular summary of information.

The initiation of a new campaign against the bagworm by the Biological Institute of the Rural Society of Argentina (*Surco, 1 (1921), No. 4, pp. 18–22, figs. 11*).—This account relates particularly to control work with the bagworm (*Oecéticus kirbeje*) by means of insect parasites, of which 13 species are listed, the tachinid *Parexorista caridei* Breth. being one of the most important.

The control of the fruit tree leaf roller, L. CHILDS (*Mont. State Bd. Hort. Bien. Rpt., 11 (1919–20), pp. 28–32*).—It is pointed out that extensive control work with *Archips argyrospila* Walk. has been carried out in New York, Colorado, and Oregon, and that the results obtained have been much the same, namely, that after the insects hatch, control from the standpoint of reducing the percentage of damaged fruits has been unsatisfactory. The causes for the failure of poison and contact sprays in destroying the worm are twofold: First, due to the high resistance of the insect to poison and, second, due to its habit of folding and tying the leaves in such a way as to prevent the thorough coating of a large proportion of the foliage upon which the insects are feeding.

In the author's opinion no present-known insecticide can be applied after the worms are hatched that will give sufficient results to warrant its use. Some protection from complete defoliation is obtained from the use of lead arsenate. Applications possessing greatest merit have invariably been those emulsions made from rather heavy refined types of oil. Light oil emulsions, such as kerosene or distillate, are much too volatile to effect killing. In work carried on at Hood River, Oreg., more eggs were found hatching on trees sprayed with an 18 per cent kerosene emulsion than on unsprayed check trees, indicating that no benefits were obtained.

It is pointed out that a thorough application of oil does not always insure successful control of the leaf roller, the causes for which are not altogether known at the present time, although the more important factors involved are weather conditions, chiefly that of temperature and rainfall at the time immediately following applications of the spray. Tests have shown conclusively that rain immediately following applications invariably reduces the percentage of eggs that would ordinarily be killed by the sprays favorably applied. The greater strengths of emulsion, i. e., 8 to 10 gal. of the oil to 100 gal. of water, give better results than does a 6 per cent emulsion applied under the same conditions.

The most consistent results obtained in the control of the leaf roller seem to point to the fact that a 22° Baumé oil can be used more effectively than a 28° oil. The use of 8 gal. of miscible oil to 100 gal. of water is now recommended.

The author has observed that poor spraying has been responsible for at least 75 per cent of the failures reported by growers. It is not an uncommon occurrence to find a tree possessing from 100 to 200 egg masses or between 5,000 and 10,000 eggs. "Our study of the problem shows that growers who obtain effective control year after year use the spray in the following proportions per tree: At 11 years, 4.1 gal. of spray; at 12 years, 4.5 gal.; at 13 years, 5.6 gal.; or an increase of about a gallon a tree per season. This observation has not been noted on trees older than 17 years. Trees of this age require 8 gal. of spray. If much less material than this is used good results can not be expected."

Colorado leaf roller in the Bitter Root Valley, R. K. THOMPSON (*Mont. State Bd. Hort. Bien. Rpt., 11 (1919–20), pp. 33–42, figs. 2; also in Mont. State Hort. Soc. Rpt. Proc., 24 (1921), pp. 25–34, figs. 2*).—The leaf roller was observed in Montana by the author for the first time in the spring of 1919, a tract of 40 acres having been more severely damaged than others. Spray Mulsion was applied from April 9 to April 29, at the rate of 7 gal. of the oil to 100 gal. of water, under a pressure of 300 lbs. to 250 acres. The result was negligible, few, if any, of the egg masses having been killed. An application of the emulsion made from May 4 to May 10, in which 150 acres were covered (about 90 acres before the leaf buds had opened and 60 acres while they were opening and the young leaves forming) at the rate of 8 gal. to 100 gal. of water, resulted in a kill of about 50 to 75 per cent on both tracts. Because of injury to the young foliage, the application was discontinued on May 10, at about which time the eggs began hatching.

The author observed that on comparatively young trees most of the egg masses were deposited on the trunk and main branches, upon which control over an area of 1,600 acres was obtained by painting the egg masses with full strength oil. A block of 100 acres of orchard most severely damaged by the worms in 1919 was pruned and headed back with success, due to increasing the vigor and stimulating the leaf growth, thus enabling it to withstand the attack of the worms.

The European corn borer, L. CAESAR (*Ontario Dept. Agr., Agr. and Expt. Union Ann. Rpt., 42 (1920), pp. 59–63*).—This summary of information includes data on the distribution of *Pyrausta nubilalis* in Canada, as well as in the United States.

Life history of the codling moth in the Grand Valley of Colorado, E. H. SIEGLER and H. K. PLANK (*U. S. Dept. Agr. Bul. 932 (1921), pp. 119, pls. 7, figs. 36*).—This is a report of biological studies of the codling moth conducted by the Bureau of Entomology in cooperation with the Colorado Experiment Station. The general character of the work, which was commenced in the fall of 1914 and extended through 1915 and 1916, is quite similar to that conducted by the Bureau of Entomology in several other fruit districts, reports of which have been noted (E. S. R., 36, p. 756).

The investigations show that there are two complete generations and a partial third in the Grand Valley, where the climate is comparatively dry and warm during the summer season and very favorable to the development of the codling moth. The average length of the pupal stage of the spring or overwinter broods was 27.58 and 26.8 days, respectively, for the years 1915 and 1916. Moths of this brood oviposited in about 6 days, and the average number of eggs per moth was about 12.

With the first generation the average periods for the years 1915 and 1916 were as follows: Incubation period 9.14 and 7.32 days, feeding period on bagged fruit 22.77 and 21.1 days, cocooning period of larvae 6.7 and 5.53 days, pupal

stage 11.44 and 11.23 days, preoviposition 2.07 and 2.21 days, life of the female moths 12.68 and 12.2, and the life of the male moth 11.86 and 13.12 days. During 1915 the average number of eggs deposited was 46.73 and in 1916 43.98. The average life cycle obtained by rearing individuals from the eggs to the adult stage by the stock-jar feeding method was 49.3 and by the bagged-fruit feeding method 49.18 days in 1915, and 44.89 days for the former and 46.37 days for the latter in 1916.

The average periods of the life cycle of the second generation for the two years were, respectively, as follows: Incubation period 7.22 and 6.93 days, feeding period of larvae 28.69 and 28.61 days, cocooning period of larvae 9.35 and 4.8 days, and pupal stage 15.62 and 13.51 days. The average number of eggs deposited per female was 45.58 in 1916. The average life cycle of this generation was 50.81 in 1915 and 42.4 in 1916.

With the third generation the average incubation period in the year 1916 was 7.77 days and the larval feeding period 37.55 days.

The seasonal history in the Grand Valley is graphically illustrated by diagrams. That for the year 1915 shows the spring brood of moths to have commenced emerging on May 12 and to have been at its height on May 24; in 1916 emergence commenced 2 days earlier but reached its height on the same date. In 1915 deposition of the first brood eggs commenced on May 15 and hatching on May 27, the maximum hatching being reached on June 17, while in 1916 both deposition and hatching commenced 4 days later, the maximum hatching occurring on June 16. With the second generation oviposition in 1915 commenced July 12 and hatching on July 19, reaching the maximum on July 21, while in 1916 oviposition and hatching commenced 9 and 10 days earlier, respectively, the maximum hatching taking place on August 8. With the third generation deposition in 1916 commenced August 12 and ended on September 21. The record for hatching of the third brood is incomplete for 1915; in 1916 it commenced on August 20, reached its maximum on September 4, and was completed on September 21.

In band studies in 1915 the percentage of larvae collected in the field that transformed to the adult stage was 45.37 and in 1916 40.88. The natural enemies observed include the two predators *Tenebroides corticalis* Melsh. and a spider, *Coriarachne versicolor* Keys, and the parasites *Trichogramma minutum* Ril., *Dibrachys clisiocampae* Fitch, and *Arthrolytus apatelae* Ashm. They, however, play a very unimportant part in checking it in the Grand Valley.

While the codling moth is believed to be a nonmigratory species except for short local flights, it appears to have strength to fly in a continuous flight, unaided by the wind, for a distance of at least one-half mile. An examination made of a pear orchard devoid of fruit revealed the fact that codling moth larvae sometimes burrow into the new growth, resulting in the browning of the foliage. The author records having reared the buff-colored variety of codling moth, known as *Laspeyresia pomonella simpsonii* Busck, in the Grand Valley.

Results from codling moth experimental work, 1918, J. A. Webber and C. B. Wood (*Yakima County, Wash. Dist. Hort. Insp. Ann. Rpt., 1918–19, pp. 16–20*).—In work with the codling moth here reported, partly in tabular form, powdered arsenate of lead appeared to give better results than the paste form. Calcium arsenate was used at the rate of 0.5 lb. to 50 gal. of water for the calyx spray without causing any burning. Nicotin sulphate used at the rate of 1:1,066 was far from satisfactory, and since this is the third season nicotin sulphate has been tried out for codling moth control, it is concluded that it is not successful for this purpose. Aphids were readily controlled with distillate oil emulsion and also with the nicotin sulphate at the rate of 1:1,066.

Codling moth control in 1920 (*Mont. State Bd. Hort. Bien. Rpt., 11 (1919–20), pp. 43–45*).—This is a brief report on control work of the year.

Further studies concerning the codling moth, J. Troop (*Ind. Hort. Soc. Trans. 1919, pp. 32–34*).—This article contains data on the dates of the emergence of the moths, etc.

The false codling moth (Argyroploce leucotreta Meyr.), D. Gunn (*Union So. Africa Dept. Agr., Sci. Bul. 21 (1921), pp. 28, figs. 6*).—This pest is said to be a native insect distributed throughout much of the Union of South Africa, though more prevalent in certain districts than in others. It causes injury to oranges, naartjes, guavas, pomegranates, apricots, peaches, plums, walnuts, olives, and persimmons. "The influence of moisture appears important in restraining its increase and reducing the amount of its injury.

"Eggs are deposited principally on the rind of the fruit and hatch in from 10 to 15 days, according to the prevailing temperature. When the larva emerges it feeds for a brief period upon the rind, and then burrows into the tissue of the fruit. Infested fruits ripen prematurely and fall to the ground, and when the larva leaves the fallen fruit it makes a cocoon on the surface of the soil. What may be called the spring moths begin to emerge early in September and continue to do so until about the end of October. They may deposit eggs on any oranges that are still on the trees. The succeeding moths begin to emerge in numbers early in January, and continue to emerge until about the end of February. Eggs are deposited by them within a few days after their emergence.

"Spraying with arsenate of lead powder in the proportion of 1.5 lbs. to 50 gal. of water gave good results and is recommended for the control of this insect."

An account of a new moth borer of sugar cane (family Tineidae); together with further notes on the pyralid moth borer of cane (Polyocha sp.), E. Jarvis (*Queensland Bur. Sugar Expt. Stas., Div. Ent. Bul. 11 (1921), pp. 15, figs. 12*).—The new tineid moth borer here considered is shown to be an important enemy of cane in Queensland.

Indian grass gall midges, E. P. Felt (*India Dept. Agr. Mem., Ent. Ser., 7 (1921), No. 3, pp. 15–22*).—This is a report on a collection of gall midges from India, of which four are described as new.

Bionomics of house flies, IV, P. R. Awati (*Indian Jour. Med. Research, 8 (1920), No. 1, pp. 80–88*).—In this continuation of the work previously noted (E. S. R., 44, p. 552), notes on the life history of Musca are presented.

The horn fly (Haematobia serrata), E. G. Smyth (*Porto Rico Dept. Agr. and Labor Sta. Circ. 39 (1921), Spanish ed., pp. 17, figs. 8*).—This account of the horn fly has been noted from another source (E. S. R., 44, p. 164).

The apple maggot in Minnesota, A. G. Ruggles (*Minn. Hort., 49 (1921), No. 4, pp. 118, 119*).—The author reports that injury by the apple maggot in Minnesota was first reported in 1918. Since that time it has increased in abundance, and in 1920 the damage caused was very great, practically all of the best apple-growing areas having been affected. It has been found in Minnesota working on hawthorn, *Symphoricarpos occidentalis*, hook or wolfberry, and several of the common varieties of Minnesota apples, like the Strawberry Crab, Wealthy, Malinda, Peerless, Northwestern Greening, and Patten Greening.

The North American species of Drosophila, A. H. Sturtevant (*Carnegie Inst. Wash. Pub. 301 (1921), pp. IV+150, pls. 3, figs. 49*).—The first part of this work deals respectively with the behavior, genetics, physiology, parasites, and other enemies, anatomy, charomosomes, intraspectific variability, and methods of collecting and preserving Drosophilinae. A systematic account of the 22 genera belonging to the Drosophilinae, next presented (pp. 48–107), is

followed by accounts of the geological history, geographical distribution, species hybrid, specific differences *v.* mutational differences, catalogue of described species of Drosophilinae (pp. 123–133), a bibliography of 8 pages, and an index.

Rearing anthomyid root maggots on artificial media (Dipt.), J. R. EYRE (*Ent. News, 32 (1921), No. 7, pp. 215, 216*).—The author records the successful rearing of the onion maggot and the cabbage maggot on agar jelly containing a high percentage extract of the larval food plant. The onion agar was prepared by adding 10 per cent commercial agar to a filtered stock of boiled onion. The cabbage agar was made in the same way, using a stock of boiled cabbage. The larvae hatched in several days and fed on or near the surface of the agar and, owing to its transparency, could be observed in each instar. Puparia were formed on the walls of the test tubes or petri dishes, but the best results were obtained by transferring the full-grown larvae to shallow containers of earth and allowing them to pupate there. Bacterial contamination of the media or the presence of large amounts of water of condensation proved fatal to the larvae and necessitated frequent transferring to fresh agar.

Annotated list of Halticini, A. B. DUCKETT (*Maryland Sta. Bul. 241 (1920), pp. 111–155*).—This is a descriptive list of 63 species of Halticini or flea-beetles, collected at College Park and vicinity, and 12 probably belonging to the fauna but not collected. The account is based upon studies by the late author, which extended over a period of several years prior to his death in October, 1918. The bulletin, which includes keys to the subtribes, genera, and species, was edited by E. N. Cory.

Garden fleahopper in alfalfa and its control, A. H. BEYER (*U. S. Dept. Agr. Bul. 964 (1921), pp. 27, figs. 17*).—This is a report of field and laboratory studies of the capsid species *Halticus citri* Ashm., conducted at Columbia, S. C., during the years 1915, 1916, and part of 1917.

In South Carolina and Georgia this species becomes abundant in early summer and continues so until late fall. Both nymphs and adults attack the leaves, petioles, and stems, causing discoloration, wilting, and in severe infestation, death. The species of American origin is widely distributed throughout the Eastern United States and occurs as far west as Utah.

"Leguminous plants appear to constitute its favorite foods and places for breeding, although its range of host plants is extremely wide. The eggs are deposited in the leaves and petioles of the food plants, usually in places where adults have been feeding. The incubation period of the egg at Columbia, S. C., covered from 6 to 16 days with an average of 11 days. The five instars of the nymph stage together cover from 10 to 18 days, with an average of 14 days. The combined length of nymph and adult stages was 25 days. In the latitude of South Carolina there are from five to six generations annually. The species was found to hibernate in the adult stage."

It is little affected by natural enemies, but changes in the weather reduce its numbers during the winter months. It is pointed out that hibernation and subsequent multiplication is prevented where weeds and plants that remain green late in the fall and resume growth in the spring are cleaned up in the fall and destroyed. In case of severe outbreaks, it is advisable to cut and remove the invaded crop and then spray the field with a 10 per cent solution of kerosene emulsion.

The flea-beetle attack in 1918, S. ROSTRUP (*Tidsskr. Planteavl, 27 (1920), No. 2, pp. 216–286, pl. 1, figs. 11*).—The habits and control of flea-beetles harmful to Danish farm crops are dealt with.

A study of natural methods of control for white grubs, J. F. ILLINGWORTH (*Queensland Bur. Sugar Expt. Stas., Div. Ent Bul. 12 (1921), pp. 20, figs. 5*).—This is a summary of investigations, particularly of the muscardine fungus,

with directions for its artificial propagation and use against white grubs, especially *Lepidoderma albohirtum* and *L. frenchi*, in Australia.

The palm weevil (Rhynchophorus ferrugineus Oliv.), S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 43 (1920), pp. V+90, pls. 12*).—This is a report of investigations of *R. ferrugineus* conducted in the Dutch East Indies. The red variety found in British India occurs in Java also, and a black variety with a longitudinal red or orange mark on the pronotum is widely spread in Java. In Sumatra only the black form is found. Biological studies of this pest are reported in detail, much of the data being presented in tabular form, and a summary in English is appended.

A serious menace to greenhouse roses, C. A. WEIGEL (*Amer. Rose Ann., 1920, pp. 66–69, figs. 2*).—The strawberry root worm or leaf beetle [(*Typophorus*) *Paria canella* Fab.], a native pest long recognized as a serious pest of strawberries and raspberries and occasionally of the apple, crab apple, juniper, and several other plants, has now been found to be of prime importance to many of the commercial rose growers of the United States. While one or two florists report that they have had experience with this pest for several years, the authentic records indicate that it has been exceptionally injurious during the last two seasons only.

The damage to rose foliage is caused mainly by the full-grown beetle, and does not differ materially from the injury done to the strawberry. The entire foliage is badly perforated and ragged, presenting a shot-hole appearance as a result of their voracious feeding. The beetles show a marked preference for the new and young shoots, their attack giving the rose a very unsightly appearance. Ultimately, the entire growth is badly stunted from the gradual killing of the affected parts, thereby reducing their commercial value.

Preliminary control experiments have shown arsenicals to be quite ineffective, the best results having been obtained by the use of hydrocyanic-acid gas against the adults. The author recommends the fumigation at night only, at the rate of 2 oz. of sodium cyanid for every 1,000 cu. ft. of space, with an exposure of two hours. Growers are advised not to bring into their houses sod or soil in which strawberries or raspberries, either wild or cultivated, have been growing.

Strawberry root worm injuring greenhouse roses, J. G. SANDERS (*Amer. Rose Ann., 1920, pp. 69, 70*).—Attention is called to the severe losses which have been caused during the past three or four years in Pennsylvania, particularly in the Philadelphia district, by (*Typophorus*) *Paria canella* Fab.

A report of some observations on the work of the Arizona authorities in connection with the Thurberia weevil, D. B. MACKIE (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 4, pp. 150–158, fig. 1*).—In addition to the account previously noted (E. S. R., 44, p. 659), this paper includes a map showing the location of proposed noncotton zones in Arizona.

Report of the apiarist [and branch farms], F. W. L. SLADEN ET AL. (*Canada Expt. Farms Rpt. 1920, pp. 41, 42, 88, 97, 98, 104, 111, 115, 123, 168, 173, 181*).—The year ended March 31, 1920, was favorable for the production of clover honey at the Central Experimental Farm, where there was an average production of 200 lbs. per colony, bringing the average per colony for the last seven years up to 134 lbs. "Lethbridge produced an equivalent of 213 lbs. to the colony, mainly from alfalfa, bringing the average annual production for the past six years up to 99 lbs. Other branch farms that scored high yields in 1919 were Invermere, B. C., 127 lbs. to the colony; Kentville, N. S., 122 lbs. to the colony; and Sidney, B. C., 109 lbs. to the colony."

A brief reference is made to the breeding experiment being conducted on Duck Island, at the eastern end of Lake Ontario (E. S. R., 44, p. 856), where complete isolation for mating purposes was found to exist. In an investigation

of northern conditions at the experimental station at Kapuskasing, Ont., two colonies sent from Ottawa early in August, 1919, were found to be doing well when visited September 11 and 12, having gathered a large quantity of honey from alsike and white clover, fireweed, and *Aster macrophyllus*.

Notes on the status of bees and bee work for the year are also included in the reports of the superintendents of the branch farms.

Bee disease law of Georgia and rules and regulations adopted by the Georgia State Board of Entomology in accordance therewith (*Ga. State Bd. Ent. Circ. 33 (1921), pp. 8*).—The text of the law and the rules and regulations promulgated are presented.

Diseases of bees in Michigan, R. H. KELTY (*Michigan Sta. Spec. Bul. 107 (1921), pp. [16], figs. 5*).—This is a popular summary of information on diseases of bees and measures for their control.

First supplement to Type Species of the Genera of Ichneumon Flies, H. L. VIERECK (*U. S. Natl. Mus. Proc., 59 (1921), pp. 129–150*).—This supplements the work previously noted (E. S. R., 30, p. 661).

An enumeration of the Japanese Aphelininae, with descriptions of two new species, S. NAKAYAMA (*Philippine Jour. Sci., 18 (1921), No. 1, pp. 97–102, pl. 1*).—The present paper enumerates 12 known species of Japanese Aphelininae, previously described, and gives descriptions of two new species.

A new pristomerine from California (Hym., Ichneumonidae), H. L. VIERECK (*Ent. News, 32 (1921), No. 6, pp. 172–174*).

American gallflies of the family Cynipidae producing subterranean galls on oak, L. H. WELD (*U. S. Natl. Mus. Proc., 59 (1921), pp. 187–246, pls. 10*).

Notes and descriptions of Neotropical sawflies of the subfamily Perreyiinae, S. A. ROHWER (*U. S. Natl. Mus. Proc., 59 (1921), pp. 161–167*).

Notes on sawflies, with descriptions of new genera and species, S. A. ROHWER (*U. S. Natl. Mus. Proc., 59 (1921), pp. 83–109*).

Some notes on the terminal abdominal structures of sawflies, W. MIDDLETON (*Ent. Soc. Wash. Proc., 23 (1921), No. 6, pp. 139–144, figs. 12*).

Cotton cultivation and the cotton stainer in Peru, C. L. ROYLE (*Trop. Life, 17 (1921), No. 6, pp. 86, 87, fig. 1*).—It is pointed out that the cotton stainer (*Dysdercus suturellus*) is a source of great damage to cotton in Peru, where, only two years ago, it caused the entire loss of the crop expected from 30,000 acres.

The apple and pear leaf-suckers, O. LUNDBLAD (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 209 (1920), pp. 20, figs. 18; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 8, pp. 534–549, figs. 18; abs. in Rev. Appl. Ent., 9 (1921), Ser. A, No. 4, pp. 155, 156*).—This is a summary of information on *Psylla mali* Sch., which is common in the southern half of Sweden, chiefly on apple but also on *Sorbus aucuparia*. The winter is passed in the egg stage on the branches, the larvæ emerging as they start into growth.

The pear leaf-suckers are said to be less harmful, very little being known about them. *P. pyrisuga* Först. does not appear to be rare, but is abundant only exceptionally and important injury seldom occurs. *P. pyri* L. is also rarely met with and *P. pyricola* Först. has not been observed in Sweden.

An undescribed aphid injurious to rice in the Philippine Islands, A. C. BAKER (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 4, pp. 159, 160, figs. 3*).—An aphid which lives upon the roots and does much damage to rice at Los Baños is described as new under the name *Dryopeia hirsuta* Bak.

A new mealy bug on citrus trees (Pulvinaria ornata n. sp.), W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 32 (1921), No. 6, pp. 427, 428, pl. 1*).—A mealy bug abundant on lemon-tree foliage in a garden near Sydney is described as

new under the name *P. ornata*. This species was found thickly infesting the foliage of a specimen of *Pittosporum undulatum* growing near the lemon tree, and this bush is probably the original and natural host of the species.

A practical method of liberating parasites of black scale in the field, H. M. ARMITAGE (*Calif. Citrogr., 6 (1921), No. 8, p. 272, figs. 3*).—In the method here described, the black scale developing on host plants in individual containers are subjected to the attack of the parasite *Aphycus lounsburyi* in small cages, which are then moved to open racks in a heated room in order to hasten the development of the parasite. Before emergence actually takes place, the individual containers are taken into the orchards in which the parasites are to be used and planted under the trees. By this method it is possible to place an individual host plant, infested with a maximum of parasitized scale, under each tree in the orchard at a cost of less than $5 per acre.

Report on lac and shellac, H. A. F. LINDSAY and C. M. HARLOW (*Indian Forest Rec., 8 (1921), No. 1, pp. X+162, pls. 14, figs. 3*).—This report deals with the lac insect (*Tachardia lacca*), the host trees of the lac insect, its distribution, and the cultivation of lac, and gives suggestions for improved methods of cultivation, collection, and storage, etc.

Control of the red spider, R. S. WOGLUM (*Calif. Citrogr., 6 (1921), No. 8, pp. 273, 304, fig. 1*).—This is a brief summary of the present status of control work, based upon interviews by the author in California.

Mite attacks on seeds, N. SIGGAARD (*Tidsskr. Planteavl, 27 (1920), No. 2, pp. 287–312, figs. 5*).—Investigations of their attack show that, lying undisturbed for months in storage, garden and field seeds that contain oil are commonly subject to attack by mites. *Tyroglyphus farinæ, T. putrescentiae, Glyciphagus domesticus,* and *Cheyletus eruditus* are the mites usually concerned. *C. eruditus* devours the three other kinds, with the effect, first, that the devouring mite can restrain the attack of the other mites, for a time, and secondly, that the number of mites attacking the seed varies at different times.

"An artificial drying process at from 40 to 60° C. in an apparatus, so constructed that the seed is in rapid motion, is preferable, owing to the wounding and crushing of the mites, and is—according to the investigation—the surest way of stopping the attack of mites. When an apparatus is used in which the seed is not in motion during the drying process, the mites do not suffer any harm worth mentioning."

FOODS—HUMAN NUTRITION.

The energy content of extra food (sandwiches), III, C. G. and F. G. BENEDICT (*Boston Med. and Surg. Jour., 184 (1921), No. 17, pp. 436–439*).—Continuing the series of studies previously noted (E. S. R., 42, p. 659), the energy value of a large variety of sandwiches, including those of meat, fish, cheese, salad, and miscellaneous fillings, is reported, together with the price and weight of the sandwiches and in some cases the weight of the bread and filling and the estimated calories in the bread alone.

The meat sandwiches weighed from 59 to 100 gm. and the total calories ranged from 166 to 286, averaging about 225 calories. Frankfort sausage sandwiches furnished approximately 250 calories with a reasonable degree of uniformity. The cheese sandwiches averaged somewhat less in weight and in calories than the meat, and the salad sandwiches somewhat more. Those classified as miscellaneous weighed about 70 gm. and furnished from 189 to 306 calories, the latter being found in nut bread sandwiches. Comparing the price with the energy value, the sandwich is not considered an economical source of energy at

the present time. Considered as an extra food taken outside the regular meals, the number of calories yielded by sandwiches is, however, by no means negligible.

Condensed milk, P. LASSABLIÈRE (*Le Lait Condensé. Paris: A. Maloine & Son, 1919, pp. [3]+111+109*).—This monograph deals with the history, manufacture, composition, and food value of condensed milk.

J. König's chemistry of human foods and condiments.—Supplement to volume 1: (a) Composition of animal fats, edited by J. GROSSFELD, A. SPLITTGERBER, and W. SUTTHOFF (*J. Königs Chemie der Menschlichen Nahrungs- und Genussmittel. Nachtrag zu Band I. A. Zusammensetzung der Tierischen Nahrungs- und Genussmittel. Berlin: Julius Springer, 1919, 4. ed., pp. VIII+594*).—This supplement to volume 1 of the series of handbooks previously noted (E. S. R., 15, p. 283) consists of a revision of the material on animal fats to include investigations reported in the literature from 1903 to 1918. Analyses are reported of different kinds of meat, fish, shellfish, meat extracts, gelatin, the milk of various animals, and milk products.

Iron and arsenic as influencing blood regeneration following simple anemia.—VI, Negative influence of familiar drugs on the curve of hemoglobin regeneration following hemorrhage, G. H. WHIPPLE and F. S. ROBSCHEIT (*Arch. Int. Med., 27 (1921), No. 5, pp. 591–603*).—Continuing the investigation previously noted (E. S. R., 44, p. 564), further evidence is presented that iron in inorganic form has no significant effect on the curve of hemoglobin regeneration in anemia following hemorrhage. Arsenic in the form of sodium cacodylate or Fowler's solution was also inert. "No drug has been tested which can compare with the meat factors in stimulating a rapid regeneration of hemoglobin during these anemia periods induced by simple hemorrhage."

Solanin and its occurrence in potatoes and potato skins, with special reference to the poisoning question, J. HANSEN (*Ztschr. Expt. Path. u. Ther., 20 (1919), No. 3, pp. 385–437*).—This paper consists of an historical review of the literature on solanin, including its occurrence, chemical properties and biological action, and reported cases of solanin poisoning. This is followed by the report of chemical and biological studies conducted by the author leading to the conclusion that the alleged solanin poisoning from potatoes can not be attributed to solanin, but to some form of bacterial toxin. The evidence leading to this conclusion is that in the gastro-intestinal tract solanin undergoes hydrolysis with the formation of solanidin, which is practically insoluble and consequently not absorbed into the blood stream.

Determinations of solanin in potatoes showed a content of 1.44 per cent in dried sprouts from 4 to 7 cm. long. Dried skins from fresh potatoes gave an average of 0.115 per cent solanin and from cooked potatoes 0.165 per cent.

On the rate of nitrogen elimination, W. S. MCELLROY and H. O. POLLOCK (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 475–481, figs. 2*).—Studies on the nitrogen elimination at 2-hour intervals for 24 hours, and the urea and nonprotein nitrogen of the blood at 1-hour intervals, in dogs after feeding lean meat are reported. The results indicate that the rate of nitrogen elimination is an index of the rate of digestion and absorption and that a large part of the nitrogen consumed is rapidly excreted in the urine, largely as urea.

Shortly after the meal the nitrogen excretion began to increase, reaching a maximum in 4 to 12 hours and returning approximately to the original level within 24 hours. The character of the curve of excretion was influenced by the protein fed. In a given experiment the curves of nonprotein and urea nitrogen in the blood and the total nitrogen and urea nitrogen in the urine ran closely parallel, but in different experiments the character of the curves varied considerably. These variations are attributed to variations in the rate of absorption of the different amino acids from the alimentary tract.

The course of creatinin elimination in human urine, with special reference to the influence of muscular work, W. SCHULZ (*Pflüger's Arch. Physiol., 186 (1921), No. 1–3, pp. 126–172*).—An elaborate investigation of the creatinin output of man at different periods of the day and as affected by food and muscular work is reported with the following conclusions:

The total output of creatinin on a creatinin-free diet decreases to about half the maximum amount and is completely independent of the amount of urine. In fasting the level of the creatinin curve sinks still lower. The output during the day shows a characteristic course with three maximum periods at from 9 to 11 a. m., 3 to 5 or 1 to 3 p. m., and 9 to 11 or 7 to 9 p. m. Neither the food nor early or late rising has any influence on the morning output, nor is the evening output appreciably influenced by a lack of the evening meal. The three maximal values remain during fasting, although the afternoon output is not so constant as on days with normal food intake.

Creatin is not found in the urine except during fasting, and disappears with resumption of food. Muscular work not only in fasting but also in normal nutrition causes an increase in the creatinin output during the same period, but does not alter the entire day's output.

A contribution to the knowledge of the metabolism of boys, G. BAUMGARDT and M. STEUBER (*Biochem. Ztschr., 111 (1920), No. 1–3, pp. 83–90*).—Basal metabolism studies by direct calorimetry with two boys 11 and 13 years old as subjects are reported. The average results obtained in four periods of two determinations each were an energy output per day of 36.7 calories per kilogram of body weight, or 907.8 calories per square meter of body surface. The respiratory quotient ranged from 0.88 to 1.005.

Investigations in the artificial feeding of children, A. L. DANIELS ET AL. (*Iowa Univ. Studies Child Welfare, 1 (1921), No. 5, pp. 11+10+[17], figs. 25*).—This consists of three papers which have been previously noted from their original sources, as follows: The Rôle of the Antineuritic Vitamin in the Artificial Feeding of Children, by A. L. Daniels, A. H. Byfield, and R. Loughlin (E. S. R., 42, p. 256); The Antineuritic and Growth Stimulating Properties of Orange Juice, by A. H. Byfield, A. L. Daniels, and R. Loughlin (E. S. R., 43, p. 460); and A Deficiency in Heat-treated Milks, by A. L. Daniels and R. Loughlin (E. S. R., 44, p. 860).

The effect of diet on mammary secretion, G. A. HARTWELL (*Biochem. Jour., 15 (1921), No. 1, pp. 140–162, figs. 8*).—The effect of diet on mammary secretion was investigated by observations of the rate of growth of rats from birth to weaning, the diet of the mother being varied to test different combinations of food materials. The weight of the mother during lactation was also noted and compared with the growth rate of the young. In every case the litter was reduced to six.

In the majority of cases the mother showed a typical initial loss of weight at the beginning of lactation. Subsequent loss or gain in weight was liable to great variation. Extractives tended to keep up the weight, as did protein. Evidence was obtained, however, that excessive protein altered the composition of the milk unfavorably, and after a time caused the milk supply to cease. Excess carbohydrate appeared to have no effect, and excess fat a slightly depressing effect on growth of the litter, but absence of fat seemed to make practically no difference.

Of the various diets tested, white bread 15 gm. and milk 100 cc. produced the best growth. This was followed in decreasing order by bread and meat; bread, butter, and meat extract; bread and butter; and bread alone. On all these diets the mother was able to produce milk which brought about at least slight

growth and kept the young in good condition, thus showing that for a time at least the mother can supply the necessary vitamins from her own diet.

Studies on the influence of the kind of food on the health of an individual, length of life, fertility, and fate of offspring, E. ABDERHALDEN (*Pflüger's Arch. Physiol., 175 (1919), No. 3–6, pp. 187–326*).—This is a summary of investigations conducted by the author and his coworkers over a period of 18 years, with a view to determining the effect of subsistence on single articles of food and purified food materials upon the span of life, ability to breed, and condition of the offspring. Following a review of the literature bearing upon the same subject, experimental data are reported of feeding experiments with rats on (1) single natural foodstuffs, (2) two or more of these materials fed alternately, (3) purified food materials, and (4) purified materials supplemented by various additions.

Rats on a polished rice diet lived in general from 100 to 200 days, the longest time reported being 305 days. The weight of the animals decreased for a time and then kept practically constant until a few days before death, when it rapidly decreased. In the majority of cases the symptoms were those of inanition. In others, however, there was evidence of paralysis, photophobia, conjunctivitis, and thickening of the cornea. Scorbutic symptoms were absent, although in some cases there were hemorrhages in the mouth. Rats which had been fed for two months or more on polished rice were found in most cases to have lost their power of breeding. This was true of both males and females. Of 175 female rats only 14 produced any young when mated with males on the same diet. None of the offspring of these rats lived more than 103 days on a polished rice diet, while the offspring of rats on a mixed diet in some cases lived as long as 191 days on polished rice.

On ordinary corn the maximum length of life was 149 days, Natal corn 235, white lupine 108, blue lupine 255, yellow lupine 153, embroyo-free grain 211, oats 252, and rye 380 days. Alternating the separate grains tended to prolong life somewhat, but not to any marked extent.

Feeding experiments with young growing rats on a diet of purified materials consisting of protein 25, starch 40, sucrose 15, cellulose 3, fat 10, and Osborne and Mendel's salt mixture 7 per cent gave results similar to those reported in the literature and to those described in the first part of the study. Addition of wheat germ 1 gm., spinach or cabbage 2.5 gm., rape seed oil or vegetable oil 1 cc., and dried yeast 0.5 gm. each had a favorable effect. Tests made of the duration of this effect by alternating the artificial diet with the diet thus supplemented showed that the favorable effect was not of long duration after the supplement had been removed from the diet.

Growth and reproduction upon simplified food supply, I, H. C. SHERMAN, M. E. ROUSE, B. ALLEN, and E. WOODS (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 503–519, figs. 9*).—This is the detailed report, with description of technique and experimental data, of the investigation previously noted from another source (E. S. R., 44, p. 760).

Amino acids in nutrition.—III, Is prolin a growth-limiting factor in the proteins of peas (Vicia sativa)?—What nucleus in zein is responsible for supplementing these proteins? B. SURE (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 443–452, figs. 9*).—On the basis of the report by McCollum et al. that the proteins of peas (*V. sativa*) are deficient and that zein supplements this deficiency (E. S. R., 40, p. 762), and of the analysis of zein reported by Osborne et al. (E. S. R., 19, p. 1006), the author has tested the various constituents of zein as a supplement to the peas in feeding experiments with rats.

No response was obtained to isolated leucin; to the leucin fraction composed of alanin, leucin, and valin; to tyrosin additions alone or with leucin and

cystin; nor to prolin even in the presence of alanin, leucin, valin, cystin, or tyrosin. "This eliminates, then, alanin, leucin, valin, tryptophan, lysin, cystin, tyrosin, and prolin as being the amino acids that are responsible for the deficient character of the proteins of peas (*V. sativa*), and since zein, which supplements the proteins of these peas, is very low in arginin and histidin, it is here suggested, particularly in view of the recent work of Dakin on protein analysis [E. S. R., 40, p. 611], that zein may contain one or more amino acids necessary for growth as yet not isolated by previous methods of technique."

The first two papers of this series have been previously noted (E. S. R., 44, p. 462.)

Researches on the rôle of fats in the utilization of proteins: Its influence on the nutritive power and toxicity of food proteins, F. MAIGNON (*Recherches sur le Rôle des Graisses dans l'Utilisation des Albuminoides. Son Influence sur le Pouvoir Nutritif et la Toxicité des protéines Alimentaires. Lyon: Impr. Réunies, 1919, pp. 287, figs. 3*).—This volume contains the full report, with experimental data, of the author's researches on the rôle of fats in nutrition, some of the separate reports of which have been previously noted through other sources (E. S. R., 41, p. 670).

Is fat starvation a causal factor in the production of rickets? H. S. HUTCHISON (*Glasgow Med. Jour., 93 (1921), No. 1, pp. 8–12*).—To determine whether fat starvation is involved in rickets the fat utilization in healthy and rachitic infants was determined by analyzing the feces for fats, soaps, and free fatty acids, and comparing the results obtained with the original fat content of the food (milk).

The maximum, minimum, and average values for percentages of fat hydrolyzed were 100, 87.9, and 95.2 in healthy children and 100, 81.6, and 96.3 in rachitic children, thus showing that the digestion of fat was not defective in rickets. In 18 analyses of the feces of rachitic children the weight of the dry feces was on an average 11.5 gm. and the average output of fat 3.91 as compared with 9.9 and 3.3 gm. in healthy children. An increase in the intake of fat in rachitic children was accompanied by a corresponding increase in fat retention.

"One can conclude, therefore, that in rickets there is no fat starvation, and that the excessive loss of calcium in this connection is not brought about through the agency of fat. This conclusion is supported by the fact that the average daily excretion of soaps in rickets was 2.2 gm. as compared with 2.5 gm. in health. Fat could only remove calcium as an insoluble soap, and as there is no increase in soaps in rickets, there is evidently no connection between the calcium loss and the fat excretion."

The effect on kittens of a diet deficient in animal fat, H. M. M. MACKAY (*Biochem. Jour., 15 (1921), No. 1, pp. 19–27, figs. 4*).—In the experiments described young kittens were fed a ration of skimmed milk, olive oil, marmite, and orange juice, a diet similar to the one with which Mellanby claimed to have produced rickets in puppies (E. S. R., 41, p. 364). On this ration the kittens became emaciated and finally stopped growing, and suffered from abdominal distension and diarrhea. "There was no evidence of rickets found in any of the kittens post mortem, but the experiments appear to indicate that kittens when given a diet deficient in fat-soluble A develop a condition similar to that found in guinea pigs and rats under the same circumstances, and that kittens are probably more sensitive than young rats to a partial deficiency of the fat-soluble accessory food factor."

The effect of a diet deficient in animal fat on the bone tissue (rib junctions) of kittens, F. M. TOZER (*Biochem. Jour., 15 (1921), No. 1, pp. 28, 29*).—

This is a brief report of an examination of the bone tissues of the kittens in the above study. While the rib junctions of the control animals were normal, all of those on the diet deficient in fat-soluble A showed marked abnormalities at the costochondral junction of the ribs. These abnormalities did not resemble those of rickets, but were similar to those noted in guinea pigs deprived of vitamin A and also indistinguishable from those caused by definite, but not severe, scurvy, as previously suggested by Delf and Tozer (E. S. R., 41, p. 167).

Comparison of the growth-promoting properties for guinea pigs of certain diets, consisting of natural foodstuffs, E. M. HUME (*Biochem. Jour., 15 (1921), No. 1, pp. 30–48*).—A large number of dietary experiments on guinea pigs originally planned to determine the antiscorbutic value of various foodstuffs and many of which have been noted from previous contributions from the Lister Institute, London, have been analyzed and the diets tabulated from the standpoint of the growth of the animals as follows:

"Growth is found to take place when green cabbage (raw or steamed), green cabbage juice, hay, and milk (raw, heated, or dried) are added to a diet of oats and bran and water. Orange juice was added when the antiscorbutic value of the ration was insufficient. Growth is found to vary according to the size of the ration given. Little or no growth is found to take place when raw white cabbage, white cabbage juice, swede juice, orange juice, onion, or germinated peas are added to the diet.

"It is argued that the diets could only have been deficient in a dietary factor of the rank of a vitamin, and that the growth-promoting factor in these experiments corresponds in its distribution among foodstuffs with the known distribution of vitamin A. As the result of these experiments guinea pigs are recommended for trial as suitable for testing the vitamin A value of nonfatty foodstuffs, for which rats are for any reason unsuitable."

The "bios" of Wildiers and the cultivation of yeast, M. IDE (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 521–523*).—The author raises several points concerning the conclusions drawn by MacDonald and McCollum in their study of the cultivation of yeast in solutions of purified nutrients (E. S. R., 45, p. 366). The conclusion that yeast is able to grow without a specific growth-promoting substance "bios" is considered misleading. "There are two kinds of proliferation of yeast, one very slow without 'bios,' and one fast with 'bios.' Between the two, there is such an obvious difference that the distinction could not be overlooked by anyone who has seen it."

Data are given of the rate of growth of yeast with and without "bios," as shown by the loss in weight of a definite amount of sugar solution during fermentation by yeast. These data show a loss in weight of the sugar solution with "bios" added to the yeast 30 times as great as without.

The "bios" of Wildiers and the cultivation of yeast, M. B. MACDONALD and E. V. MCCOLLUM (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 525–527*).—In reply to the above paper the authors review briefly their experimental work on the cultivation of yeast with various media, and reaffirm their conclusion that "neither the hypothetical 'bios' nor the antineuritic or other uncharacterized dietary factor essential in the nutrition of mammals need be supplied in order to enable yeast to develop." In explanation of the more rapid rate of proliferation of yeast in media containing extracts of natural foods, attention is called to the recent papers of Fulmer et al. (E. S. R., 45, p. 565) in which evidence is furnished that the raising of the viscosity of the solution may be of importance in favoring the growth of the yeast. This factor and the improvement in the nutrient substances are thought to be a sufficient explanation of the difference in the rate of proliferation.

The relation of plant carotinoids to growth and reproduction of albino rats, L. S. PALMER, C. KENNEDY, and H. L. KEMPSTER (*Jour. Biol. Chem., 46 (1921), No. 3, pp. 559–577, figs. 2*).—Following an extensive and critical review of the literature on the possible relationship between vitamin A and the lipochrome pigments, the authors report experimental data showing that the carotinoid pigments are completely absent in the albino rat, the experimental animal used in most of the biological studies on vitamin A, and that growth and reproduction of rats took place on diets in which ewe milk fat containing only 0.00014 per cent of carotin was the sole source of vitamin A and similarly when this vitamin was furnished by carotinoid-free egg yolk. As a final proof of lack of relationship between vitamin A and the carotinoid pigments, a quantitative comparison was made of the carotin content and vitamin A efficiency of various rations as reported in the literature. The results of this comparison showed that the substances are not even quantitatively associated in the plant tissues in which both are presumably synthesized.

The existence of a leuco form of the vitamin, as suggested by Steenbock to cover the exceptions to the association of pigment and vitamin, is thought to be scarcely possible, in view of the fact that the only leuco forms of carotinoids thus far produced are oxidation products and that oxidation destroys the efficiency of vitamin A.

Concerning vitamins, E. C. VAN LEERSUM (*Nederland. Tijdschr. Geneesk., 65 (1921), I, No. 16, pp. 2137–2154, figs. 6*).—A digest of data.

Vitamins in milk, M. J. ROSENAU (*Boston Med. and Surg. Jour., 184 (1921), No. 18, pp. 455–458*).—A general discussion of the content and stability of vitamins A, B, and C in milk.

The rôle of vitamins in nutrition, H. CHICK (*Wiener Med. Wchnschr., 70 (1920), No. 9, pp. 411–419*).—This paper summarizes briefly the rôle of vitamins in the prevention of beriberi and scurvy.

In conclusion, the author points out that the need of vitamins is proportional to the metabolism, an increase in vitamins being necessary in the case of severe muscular work, as shown by the fact that in Arctic expeditions scurvy begins first with the crew and later with the leaders. A larger amount of vitamins is also needed during growth, pregnancy, and nursing, conditions involving increased metabolism.

Tables are given of the relative antiscorbutic value of different foods on the basis of orange juice = 100, and the antineuritic value on the basis of wheat embryo = 100.

Polyneuritic and cerebellar accidents in pigeons submitted to a régime of polished rice, A. LUMIÈRE (*Bul. Acad. Méd. [Paris], 3. ser., 83 (1920), No. 4, pp. 96–101*).—From observations on pigeons on diets of polished rice, the author has come to the conclusion that the symptoms exhibited as the result of such a diet are similar to those of inanition, and that anorexia is the real cause of the various manifestations attributed to lack of vitamins.

Anorexia in pigeons nourished on polished rice and the rôle of vitamins in nutrition, A. LUMIÈRE (*Bul. Acad. Méd. [Paris], 3. ser., 83 (1920), No. 13, pp. 310–313*).—In continuation of the above study, the author has attempted to explain the anorexia of pigeons fed on polished rice by a comparison of the changes taking place in the crops of pigeons forcibly fed on unpolished and polished rice, respectively. It was found possible to forcibly feed from 50 to 60 gm. of unpolished rice daily for several weeks, while in similar experiments with polished rice, the rice, even when fed in small amounts, 30 gm. daily, accumulated in the crop with gradual distension until intolerance for the food led to regurgitation. On opening the crop several hours after a large amount of rice

had been forcibly fed, the unpolished grains were found to be abundantly impregnated with secretions, while the polished rice was much drier. The administration of a few centigrams of extract of brewery yeast to pigeons forcibly fed with polished rice to the point of intolerance led to abundant secretions from the glands of the crop and a rapid evacuation of the contents of the digestive tract.

"Pigeons submitted to a régime of polished rice die, therefore, of inanition because they lose their appetite. This anoxeria seems due principally to the insufficiency of the functioning of the glands of internal secretion, whose normal activity appears due to the presence in foods of substances which excite it. The vitamins intervene to fill the excito-secretory rôle, as well as to maintain the tonus of the organs of digestion."

Avitaminosis and inanition, A. LUMIÈRE (*Bul. Acad. Méd. [Paris], 3. ser., 84 (1920), No. 38, pp. 274–276, figs. 2*).—As a further proof that the phenomena of inanition and avitaminosis are essentially identical and that the absence of vitamins does not intervene directly in the production of polyneuritic symptoms, pigeons were fed a diet quantitatively insufficient, but rich in vitamins, the daily ration consisting of 4 gm. of polished rice, 2 of glucose, and 1 of dried brewery yeast. On this diet the classical symptoms of polyneuritis are said to have appeared in from 12 to 14 days, and to have been cured by the administration of a quantitatively sufficient amount of polished rice.

Beriberi in the Mesopotamian Force, C. A. SPRAWSON (*Quart. Jour. Med., 13 (1920), No. 52, pp. 337–355, figs. 3*).—The author discusses beriberi as it occurred during the Mesopotamian campaign in 1915 to 1919 among (1) the British land forces, (2) the Chinese land laborers, and (3) the Indian crews.

Although the clinical picture was approximately the same, the etiology of each of the three classes was different. Evidence is presented that the British cases were not due to a food deficiency but were of an infective origin, that the Chinese cases were suffering from latent beriberi when they landed in Mesopotamia and the attack was brought on by fatigue or the onset of any other disease or debilitating factors, and that the ship beriberi occurring among the Indian crews was due to vitamin deficiency. Attention is called to the similarity in causative agents of these types of human beriberi with McCarrison's observations that polyneuritis gallinarum can be induced quite rapidly by infection with *Bacillus suipestifer* in pigeons fed an abundance of grains, while a longer time is required for the onset of the disease in subjects on a totally avitaminic diet.

Glyoxalase in avian beriberi, G. M. FINDLAY (*Biochem. Jour., 15 (1921), No. 1, pp. 104–106*).—In an effort to determine the possible connection between absence of the antineuritic vitamin and carbohydrate metabolism, estimations were made of the glyoxalase content of the livers of control pigeons, pigeons suffering from beriberi, and pigeons cured of beriberi by the administration of vitamin B.

In pigeons suffering from beriberi there was a reduction in the glyoxalase content of the liver by more than one-half that of the control birds. The administration of vitamin B produced a definite rise in the content of glyoxalase, but vitamin B does not act as a co-enzym for glyoxalase as suggested by Dutcher for catalase (E. S. R., 40, p. 563), as shown by its failure to cause increased production of glyoxalase except when acting through the intact cell. "There is thus some evidence to show that in avian beriberi a definite breakdown in carbohydrate metabolism occurs, though whether such a breakdown is followed by the production of toxic substances in the tissues is still undetermined."

[Pellagra studies] (*Pub. Health Serv. U. S. Hyg. Lab. Bul. 120 (1920), pp. 156, pls. 9, figs. 8*).—This bulletin publishes in full the data obtained in the study of the experimental production of pellagra in human subjects by means of diet which was conducted by the U. S. Public Health Service at the Rankin Farm of the Mississippi State Penitentiary and which has been previously noted from a preliminary report (E. S. R., 34, p. 258). The various phases of the investigation are considered in the following papers: The Experimental Production of Pellagra in Human Subjects by Means of Diet, by J. Goldberger and G. A. Wheeler (pp. 7–116); The Chemical Composition of the Rankin Farm Pellagra-producing Experimental Diet, by M. X. Sullivan and K. K. Jones (pp. 117–126); A Biological Study of a Diet Resembling the Rankin Farm Diet, by M. X. Sullivan (pp. 127–140); and Feeding Experiments with the Rankin Farm Pellagra-producing Experiment Diet, by M. X. Sullivan (pp. 141–156).

Determination of the minimum doses of some fresh citrus fruit juices which will protect a guinea pig from scurvy, together with some observations on the preservation of such juices, A. J. Davey (*Biochem. Jour., 15 (1921), No. 1, pp. 83–103*).—The investigation reported in this paper was concerned with the establishment of minimum antiscorbutic doses of fresh lemon, orange, and lime juices and with the effect upon their antiscorbutic properties of prolonged storage of the juices under varying conditions. The method employed was in all cases that of Chick et al. (E. S. R., 42, p. 57), the fruit juices tested being given in daily doses administered by pipette to young growing guinea pigs on a basal ration of oats and bran plus from 60 to 90 cc. of autoclaved milk. Presence or absence of hemorrhages was taken as the decisive symptom in the diagnosis of scurvy. Throughout the report earlier work on the subject, as noted in the above reference and in other contributions from the Lister Institute, has been incorporated, the present work in many cases consisting of an extension of the earlier studies.

The minimum daily doses of the three citrus fruits needed to protect the guinea pig from scurvy were established as lemon and orange 1.5 cc. and lime 5 cc. These values were used as a basis for comparing the antiscorbutic properties of the juice of oranges and lemons kept for varying times at different temperatures, alone, with the rind oil, and in the case of lemon juice with the addition of sodium sulphite. Preservation with sulphite appeared to be satisfactory at low temperatures, uncertain at room temperature, and unsatisfactory at 37° C. Preservation with the rind oil was satisfactory and reliable at about 0° and room temperature, but unsatisfactory at 37°. Experiments on the preservation of oranges and lemons in cold storage were not particularly satisfactory on account of the fact that the fruit did not keep well for any length of time, but the results indicated that the antiscorbutic property was not seriously diminished so long as the fruit remained edible.

The antiscorbutic value of dried milk, H. Jephcott and A. L. Bacharach (*Biochem. Jour., 15 (1921), No. 1, pp. 129–139, figs. 6*).—The method used in this comparative study of the antiscorbutic value of milk dried in various ways constisted in reconstituting the milk powder with three times its weight of hot water and feeding it daily to guinea pigs apart from the fresh oats and bran which made up the basal ration. Four varieties of milk were used, including summer milk, winter milk, a neutralized milk dried by the roller process, and a commercial sample of milk dried by the spray process.

In the case of the summer and winter milks dried by the roller process, the antiscorbutic values were found to be about equal to one another and to those

of the original raw milks. "The neutralized milk had an antiscorbutic value slightly less than that of the raw milk, and the spray process dried milk was markedly deficient in antiscorbutic value. Of the summer and winter dried milks, a daily dose of 26 cc. per 100 gm. body weight of reconstituted milk was, on the average, sufficient to afford protection against scurvy in the guinea pig."

Investigation of the antiscorbutic value of full cream sweetened condensed milk by experiments with monkeys, E. M. HUME (*Biochem. Jour., 15 (1921), No. 1, pp. 163–166*).—This paper supplements the earlier study by Barnes and Hume on the relative antiscorbutic value of fresh, dried, and heated cow's milk (E. S. R., 42, p. 760) by a study with the same technique of the antiscorbutic value of a sweetened full cream condensed milk prepared by a commercial condensed milk company.

The milk was prepared by first heating in a vessel with continuous inflow and outflow at 80° C., the milk remaining at this temperature about 3½ minutes. Sugar was then added and the milk boiled in a vacuum condenser for about three hours, after which it was cooled in bulk with access of air. As judged by feeding experiments with monkeys, this process of condensing milk brings about no appreciable loss in vitamin C, nor incidentally in vitamin A. The nondestruction of vitamin C in this process is attributed to the low temperature and absence of air. While these experiments show little if any vitamin destruction in such milk, it is stated that the extreme dilution of the milk for infant feeding produces a dilution of vitamins to an extent likely to be dangerous, although the high percentage of sugar gives an adequate calorie supply.

Direct inoculation test for Bacillus botulinus toxin: Determination of the presence of B. botulinus toxin by intraperitoneal inoculation of laboratory animals with suspected foods, I. A. BENGTSON (*Pub. Health Rpts. [U. S.], 36 (1921), No. 29, pp. 1665–1671*).—"The results of the experiments here presented indicate that the intraperitoneal inoculation of mice or guinea pigs with suspected foods is a useful method for the quick determination of the presence of the toxin of *B. botulinus* in foods and for determining the type of organism present. By the inoculation of a series of three mice, one with culture alone, one previously inoculated with type A antitoxin, and another with type B antitoxin, it may be possible to determine within a short time which type is the causative organism and therefore which type of antitoxin should be used for treatment."

Differentiation of type A and type B botulinus toxins in food, a rapid and simple method, R. GRAHAM and H. SCHWARZE (*Jour. Amer. Med. Assoc., 76 (1921), No. 25, pp. 1743, 1744, fig. 1*).—The authors find that the toxins of types A and B of *Bacillus botulinus* can be quickly differentiated by administering to chickens. The results of experimental tests show that they are susceptible to type A toxin, yet are highly refractory to type B toxin. The presence of type A toxin is manifest in a general paresis and coma in a few hours.

ANIMAL PRODUCTION.

Textbook of comparative physiology of domestic mammals, edited by W. ELLENBERGER and A. SCHEUNERT (*Lehrbuch der Vergleichenden Physiologie der Haussäugetiere. Berlin: Paul Parey, 1920, 2. ed., rev., pp. IX+489, figs. 368*).—This revision retains the same general characteristics as the first edition (E. S. R., 23, p. 670). Much of the revision has been done by the editors, who now assume responsibility for the chapters on urine and animal heat and contribute new chapters on intermediate metabolism and embryonic development.

The genetics of the Dutch rabbit.—A reply, W. E. CASTLE (*Jour. Genetics, 10 (1920), No. 4, pp. 293–299*).—This is a reply to Punnett (E. S. R., 44, p. 363), in which the author maintains the validity of his application of the hypothesis of multiple allelomorphs to the inheritance of the Dutch pattern in rabbits.

Is the fertile tortoise-shell tomcat a modified female? C. C. LITTLE (*Jour. Genetics, 10 (1920), No. 4, pp. 301, 302*).—Replying to Doncaster (E. S. R., 44, p. 362), the author points out that the only fertile tortoise-shell male cat of which there is authentic record produced male as well as female offspring. This would be expected on the hypothesis of nondisjunction, but it is difficult to explain if the tortoise-shell male had been a female (i. e., had two X chromosomes) modified to resemble a male in anatomical characteristics.

Factors influencing quality and composition of sunflower silage, M. J. BLISH (*Montana Sta. Bul. 141 (1921), pp. 22*).—The author reports chemical determinations on sunflowers harvested at four stages of maturity in August and September, 1919, and the same material after being ensiled for about three months in galvanized iron cans 7.5 ft. high and about 2 ft. in diameter. Each can was provided with an outlet to permit free drainage. Silos 1–4 were filled with fresh-cut material at the four successive stages and were drained, the juice being collected and analyzed. The outlet of silo 5 was kept closed, and in the case of silo 6 the material was allowed to wilt for three days before being chopped and packed. Although the outlet of silo 6 was left open, no juice drained off. Certain of the data are included in the following table:

Influence of stage of maturity at harvest and method of treatment on the composition of sunflower silage.

Silo.	Stage of maturity.	Sunflowers ensiled.	Juice collected.	Silage recovered.	Dry matter in—		Protein in—		Crude fiber in—		Sugars in sunflowers.	Mannitol in silage.
					Sunflowers.	Silage.	Sunflowers.	Silage.	Sunflowers.	Silage.		
		Lbs.	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	In bud	1,058	115	815	15.5	16.6	1.36	1.24	4.02	5.42	1.64	0.32
2	In bloom	1,052	73	874	16.4	16.7	1.43	1.32	4.53	5.36	1.70	.29
3	Seeds forming	1,071	106	904	16.9	18.5	1.45	1.41	4.81	5.88	1.87	.89
4	Seeds formed	1,099	112	949	17.0	18.3	1.33	1.43	4.75	5.72	1.90	.90
5	Seeds forming	735	[1] 0	779	18.6	17.4	1.52	1.26	5.00	5.22	2.32	1.31
6	Seeds, wilted	507	0	496	29.6	27.8	2.59	2.50	7.48	6.64	4.46	2.53

[1] Drainage outlet closed.

The sugar determinations in the table represent the sums of the percentages of reducing and nonreducing sugars computed as dextrose and sucrose, respectively. Not enough sucrose was present in most cases to account for the mannitol formed, and it is concluded that most of the reducing sugar was really fructose. No sugars appeared in the silage. Considerable acid and some ethyl alcohol were present in all the silage samples, the largest percentage occurring where the plants were ensiled at the earlier stages of maturity. Nearly 25 per cent of the nitrogen of the fresh sunflower plants was in the nonprotein form. The proportion of nonprotein nitrogen was greatly increased by the fermentation process, due largely to an increase in the percentage of amino nitrogen. It is not believed, however, that there was any serious loss in the nutritive value of the nitrogen compounds as a result of the extensive protein hydrolysis.

The silage made when the seeds were practically fully formed (silo 4) was of superior quality, and the material in silos 1–3, while somewhat watery, had good odor and flavor. The silage made from the wilted plants was very satis-

factory, and still better results from this method of treating the plants were secured with the 1920 crop. In that year also silage from frozen sunflowers was of good quality.

The author has made an investigation of the failure to secure good sunflower silage at the Huntley Reclamation Project Experiment Farm in the Yellowstone Valley. The silage made in this region undergoes a putrefactive fermentation with the production of large amounts of butyric acid and is unfit for feeding purposes. The failure, at least with the 1920 crop, is attributed largely to an abnormally low sugar content. It is noted that farmers who correct this deficiency by mixing corn with the sunflowers often secure good silage.

Valuable hints for feeders of cottonseed feed products, A. E. LANGWORTHY (*Kans. Agr. Col. Ext. Circ. 27 (1921), pp. 4, fig. 1*).—This consists of a diagram and description of the process of milling cotton seed, with particular reference to the control of the hull content of the finished meal and cake.

Report of analyses of commercial feedstuffs (*La. Dept. Agr. and Immigr. Feedstuffs Rpt. 1919–20, pp. 122*).—Proximate analyses are reported of samples of cottonseed meal, cottonseed feed, rice bran, rice polish, wheat bran, wheat middlings, wheat shorts, wheat mixed feed, corn chop, corn bran, hominy feed, corn gluten feed, brewers' dried grains, velvet bean feed, garbanza bean feed, palm kernel meal, and a variety of proprietary mixed feeds, molasses feeds, and poultry feeds.

Commercial feeds, 1920, J. M. PICKEL (*N. C. Dept. Agr. Bul., 1921, Feb., pp. 73*).—Determinations of the protein, fat, and crude fiber in samples of the following feeding stuffs are reported: Alfalfa meal, barley feed, ground barley, brewers' dried grains, Brazilian brown beans, cracked corn, corn bran, corn meal, corn-and-cob meal, hominy feed, cottonseed meal and feed, dried beet pulp, flax plant by-product, peanut oil feed, rice bran, rice polish, rice meal, rice hulls, rye middlings, rye mixed feed, soy beans, velvet bean feed, wheat bran, wheat middlings, wheat shorts, red dog, wheat mixed feed, wheat screenings, meat scrap, tankage, fish meal, semisolid buttermilk, and a variety of proprietary mixtures, hog feeds, and poultry feeds.

Inspection of commercial feeds, P. H. WESSELS and F. P. GROSS, JR. (*Rhode Island Sta. Ann. Feed Circ., 1921, pp. 3–12*).—This is a report on the protein and fat content of samples of feeding stuffs collected in 1920. The materials include cottonseed meal and feed, linseed meal, corn gluten feed, hominy feed, corn oil meal, brewers' dried grains, dried beet pulp, wheat bran, wheat bran with screenings, wheat middlings, wheat mixed feed, semisolid buttermilk, and various proprietary stock, calf, and poultry feeds.

Feeding stuffs inspection, J. L. HILLS, C. H. JONES, ET AL. (*Vermont Sta. Bul. 220 (1921), pp. 15–23*).—This is a report of the official feeding stuffs inspection in 1920, and includes a table showing the range in protein content of samples of cottonseed meal, cottonseed feed, linseed meal, corn meal, corn gluten feed, hominy feed, brewers' dried grains, coconut meal, peanut feed, velvet bean meal, wheat bran, wheat middlings, red dog, wheat mixed feed, dried beet pulp, alfalfa meal, ground oats, and various proprietary feeds.

Feed inspection for 1920, W. H. STROWD, D. R. MIHILLS, and H. CHURCHILL (*Wis. Dept. Agr. Bul. 32 (1920), pp. 37*).—Determinations of the protein, fat, crude fiber, and nitrogen-free extract are reported of samples of cottonseed meal and feed, linseed meal, linseed cake, linseed meal and screenings oil feed, barley feed, buckwheat bran, corn gluten feed, corn feed meal, corn oil meal, hominy fed, oat hulls, wheat bran, wheat middlings, wheat shorts, red dog, wheat mixed feed, brewers' wet grains, brewers' dried grains, meat scrap, and a variety of proprietary mixed feeds, calf meals, and poultry feeds.

Cooperative shipping of live stock, T. R. Reid (*Ark. Agr. Col. Ext. Circ. 102 (1921), pp. 14, figs. 3*).—This consists of suggestions for the cooperative shipment of live stock, with particular reference to Arkansas conditions. A model constitution and by-laws for a cooperative live stock shipping association are included.

[Cattle feeding experiments in Canada] (*Canada Expt. Farms Rpt. 1920, pp. 86, 87, 102, 103, 144, 145, 153, 157*).—In a fattening experiment involving comparisons between scrub cows, Shorthorn or grade Shorthorn cows, grade Shorthorn steers, and steers of the dairy breeds conducted at Charlottetown, P. E. I., and reported by J. A. Clark (pp. 86, 87), it was found that the steers made profitable gains, but the cows made only about half the gain of the steers and were fed at a loss, due in part to the high local price for dry cows because of their value as feed for foxes in the fall.

In a test with 23 steers at Nappan, N. S., reported by W. W. Baird (pp. 102, 103), little difference was found between the gains of steers tied in the barn and steers loose in the stall. The two lots consisting of steers in excess of 1,000 lbs. in weight yielded greater profits than the two lots of steers having initial weights between 800 and 900 lbs. No increased gain resulted from substituting cottonseed and linseed cake for oats in a ration of bran, oats, and screenings.

At Morden, Man., E. M. Straight (pp. 144, 145) reports confirmation of earlier experiments (E. S. R., 43, p. 771) showing that steers fattened in a barn gained more rapidly than those fattened in the open under Manitoba winter conditions. A heavy ration of roots in the early part of the feeding period produced rapid gains.

In an experiment conducted at Brandon, Man., reported by W. C. McKillican (p. 153), a lot of steers fed a mixture of recleaned elevator screenings ("Standard Stock Food") and bran (5:2) made a daily gain of 2.13 lbs. per head, whereas a similar lot fed oat chop gained only 1.42 lbs. A similar experiment with screenings has also been noted from the Morden Station (E. S. R., 43, p. 672).

In another experiment, reported from Indian Head, Sask., by N. D. Mackenzie (p. 157), a lot of steers fed the recleaned screenings made a daily gain of 1.37 lbs. per head, while a similar lot fed barley gained 1.68 lbs.

Grain sorghums v. corn for baby beeves, J. M. Jones (*Breeder's Gaz., 80 (1921), No. 3, pp. 81, 82*).—This is a brief report of a 165-day feeding experiment, begun November 29, with three lots of 400-lb. calves. Lot 1, fed ground ear corn with the shock, cottonseed meal, alfalfa, and sorghum hay, made an average daily gain of 2.02 lbs. per head. Lot 2 was fed ground feterita heads in place of the ear corn and made a gain of 2.06 lbs., while lot 3, fed ground milo heads, gained 1.99 lbs. The gains were most economical in the case of lot 2. The test was made at the Texas Experiment Station.

Feeding sorghum pomace as silage to cattle, C. E. Kellog (*Ga. Col. Agr. Bul. 221 (1921), pp. 12, figs. 3*).—In demonstration experiments at the Georgia State College of Agriculture 80 480-lb. steers, fed an average ration of 36 lbs. of sorghum pomace silage, 6.07 lbs. of cottonseed meal, 5.4 lbs. of cottonseed hulls, and a very small amount of molasses, made an average daily gain of 2.11 lbs. per head during a feeding period of 105.5 days. Analysis of the sorghum pomace silage by M. W. Lowry showed it to contain 73.5 per cent moisture, 1.14 per cent crude protein, 7.82 per cent crude fiber, and 14.74 per cent nitrogen-free extract. The heads but not the leaves are removed from the sorghum plants before sirup extraction. Water is added to the pomace when it is put in the silo.

Feeding cotton seed and cottonseed products to range steers, E. B. Stanley (*Arizona Sta. Bul. 93 (1921), pp. 481–491, figs. 2*).—The author reports

a 13-week feeding experiment with 50 range steers divided into six lots. Two lots received a standard ration of cottonseed meal (4 lbs. when on full feed) alfalfa hay, and silage, and two other lots received the same roughage, but were given cottoon seed either whole or crushed (8 lbs. per head daily when on full feed). When fed in this way it was found that 1 lb. of cottonseed meal (containing 33.6 per cent protein and 7.7 per cent fat) is equal to 1.7 lbs. of whole cotton seed (containing 18.5 per cent protein and 15.7 per cent fat). Crushing the seed did not increase the gain.

Another lot fed almost exclusively on cottonseed meal and cottonseed hulls with a very limited allowance of alfalfa hay and silage made good gains during the early part of the experiment, but the gains diminished rapidly in the last few weeks. On the other hand, a lot fed silage as sole roughage and the same ration of cottonseed meal (5 lbs. when on full feed) made satisfactory gains throughout.

Proximate analyses of the corn silage fed during the last 10 weeks of the trial, the alfalfa hay fed, and the three cottonseed products are included. Sorgo silage was fed during the first 3 weeks.

The best kinds and grades of salt to use [for cattle], R. L. HENSEL (*Breeder's Gaz., 80 (1921), No. 6, p. 181, fig. 1*).—In a cooperative experiment conducted by the Kansas State Agricultural College on a private farm in 1920 it was found that cattle on pasture consumed about 2.83 lbs. of salt per head during July, 1.80 lbs. in August, 1.17 lbs. in September, and 1.2 lbs. in October. Owing to weathering about twice these amounts of salt were necessary. The cattle preferred granulated rock salt and blocks of evaporated rock salt to the harder blocks produced under pressure.

Color inheritance in cattle, K. KUIPER (*Jour. Heredity, 172 (1921), No. 3, pp. 102–109, figs. 8*).—This is a report, with additional illustrations, of a breeding experiment with Dutch Belted cattle previously noted (E. S. R., 43, p. 375).

A herd of albino cattle, J. A. DETLEFSEN (*Jour. Heredity, 11 (1920), No. 8, pp. 378, 379, figs. 2*).—This is the record of the occurrence of albino cattle in a herd of Holsteins in Minnesota. The animals examined by the author had pink eyes and showed no pigment on the skin, horns, or hoofs, except in one case where a small black spot appeared on the ear. The original albinos were a bull and a heifer, both the offspring of the same sire, a purebred Holstein, by unrelated grade dams. This sire produced about 18 other calves, all pigmented. According to the breeder's recollection—his records were destroyed by fire—the albino bull mated to Holstein cows produced about 20 albinos and no pigmented offspring. It was also stated that the mating albino×albino yielded only albinos.

Polydactylism in cattle, E. ROBERTS (*Jour. Heredity, 12 (1921), No. 2, pp. 84–86, figs. 6*).—A case of hereditary polydactylism in cattle is reported.

A grade Holstein cow with three toes on each foot was mated to a normal bull and produced another cow with the same toe characters. This cow in turn mated to a normal bull produced three bull calves, all polydactylous. One of these showed four toes on one hind foot and five on the other. In the three-toed animals the extra toe was on the inside, and it is suggested that it represents the development of digit II.

Sheep [feeding at Morden, Man.], E. M. STRAIGHT (*Canada Expt. Farms Rpt. 1920, p. 145*).—In a 4-week experiment in the fall of 1919 a lot of 8 lambs fed bean straw, roots, oats, and bran did not gain as rapidly during the early part of the experiment as a lot fed alfalfa in place of the bean straw, but toward the end they made substantial gains and returned a greater profit than the alfalfa-fed lot.

Sheep raising on the North Coast, J. W. MATHEWS (*Agr. Gaz. N. S. Wales, 32 (1921), No. 2, pp. 91–96*).—Experiences extending over 10 years are cited to show that the raising of sheep, even the Romney Marsh breed, is not likely to become a profitable enterprise on the North Coast of New South Wales, owing to the excessive rainfall and the high temperature.

On dental incrustations and the so-called "gold-plating" of sheep's teeth, T. STEEL (*Linn. Soc. N. S. Wales Proc., 45 (1920), pt. 3, pp. 324–328*).—The author reports mineral analyses of the incrustations often found packed around the teeth of sheep, cattle, man, and other mammals. The inorganic matter present consists largely of calcium and magnesium salts, with the phosphates usually exceeding the carbonates. No trace of iron or other heavy metal was found. In sheep these incrustations often have a yellow metallic appearance, which has led to sensational statements about "gold-plating" on the teeth of sheep.

[Experiments with swine in Canada] (*Canada Expt. Farms Rpt. 1920, pp. 20, 21, 162, 172, 190*).—The general results of experimental work with the self-feeder, types of housing in winter and in summer, and the management of summer litters at the Central Experimental Farm are reported by G. B. Rothwell (pp. 20, 21).

All the tests seem to indicate that self-fed hogs require about 0.1 lb. more grain per pound of gain than trough-fed hogs. The saving in labor does not compensate for the increased cost of gain from self-feeding. In another comparison between self-feeding and hand-feeding, reported from the Rosthern, Sask., Experimental Farm by W. A. Munroe (p. 162), the self-fed hogs made nearly twice the gain with somewhat more than twice the feed. The self-fed lot reached market condition more rapidly than those on limited rations.

In a study of substitutes for skim milk for feeding young pigs, reported from Agassiz, B. C., by W. H. Hicks (p. 190), fairly satisfactory results seem to have been obtained by the use of either linseed meal or tankage to the extent of 10 per cent of the grain ration. Tankage to the extent of 20 per cent of the ration when on full feed did not prove so valuable.

The average results of a comparison between breeds at Lacombe, Alta., are reported by B. C. Milne (p. 172). In these experiments the Berkshires required 5.15 lbs. of grain per pound of gain, the Yorkshires 5.15 lbs., and the Duroc-Jerseys 5.71 lbs.

Hog feeding trials, G. A. BROWN (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 6–8*).—The author reports the average results of three feeding trials designed to study the value of rye and barley as feeds for hogs. It is pointed out that these two grains are available in Michigan two or three months before corn is ready for feeding. Seven self-fed lots appear to have been involved in each trial. The number of hogs used and the duration of the feeding periods are not stated.

Rye proved superior to barley in economy of gain (as measured by total feed consumption per unit gain) whether fed with tankage or with standard middlings and tankage. With middlings and tankage the rye formed the most economical combination tested, although the gains were lower than in the other lots. The addition of middlings to the barley and tankage combination also increased the economy of gain. The check ration of corn and tankage produced the greatest gains and ranked second in economy of gain. The lots fed corn, rye, and barley with tankage ranked second in rate of gain, but this ration was no more economical than one of rye and barley with tankage.

The importance of vitamins in pig feeding, J. C. DRUMMOND (*Pig Breeders' Ann., 1921, pp. 12–18*).—The author lists a variety of feeds known to contain one

or more of the recognized vitamins, together with a rough estimate of the relative vitamin content.

Inheritance in swine, J. L. LUSH (*Jour. Heredity, 12 (1921), No. 2, pp. 57–71, figs. 14*).—This is a report of some results of inheritance studies at the Kansas Experiment Station, begun by E. N. Wentworth and terminated abruptly in the spring of 1918 owing to circumstances connected with the war. The original crosses involved the use of European wild boars (Schwarzwald type) on Tamworth and Berkshire sows and a Berkshire boar on Duroc-Jersey and Tamworth sows. The results as to face and ear characteristics have been noted from the 1918 report of the station (E. S. R., 41, p. 74).

The 38 F_1 wild×Tamworth pigs showed longitudinal brown and sandy stripes on the body. The 17 F_1 wild×Berkshire also showed these stripes, but the dark stripes were less red, while the light stripes on the belly were much lighter, almost white. In addition, black spots appeared on the under surface. The 4 F_2 of the Tamworth cross showed clear evidence of segregation in body markings, and it is concluded that there are at least two independent factors concerned, one for black spots and the other for stripes. In addition, it is suggested that there is a factor for intensity of stripes linked to the factor for spots.

Of the 10 F_1 of the Berkshire×Tamworth cross 8 were red with small black spots and two were self-red. In the Berkshire×Duroc-Jersey cross there were 29 F_1s all red with black spots, the red becoming lighter as the pigs grew older. There were 12 classes of body color, including various combinations of black, red, sandy, and white, recognized among the 148 F_2 individuals of this mating, but it is concluded that the results in this generation and also those secured in a back cross to the Duroc-Jerseys can be satisfactorily explained by postulating three factors in addition to the dominant black carried by the Berkshire. Two of these are concerned with the production of the sandy color, and if both are present the color is red. The third factor is linked to black and acts as a diluter to one of the sandy factors when the other is absent. Some "bicolor reds" also appeared in the F_2, but the author finds it difficult to account for them.

Some notes on the variability in growth of the crossbreds in comparison with the purebreds are included.

Experimental feeding of horses, G. A. LANGELIER (*Canada Expt. Farms Rpt. 1920, p. 120*).—Records collected at Cap Rouge, Que., are tabulated, showing the average feed consumption of 2 colts and 7 fillies from the age of 5 to 33 months and also the feed consumption of 2 mature work horses during 2.5 years.

Progress in horse breeding, W. S. ANDERSON (*Jour. Heredity, 12 (1921), No. 3, pp. 134–137, fig. 1*).—This is a study of the speed records of the Standardbred and the Thoroughbred, with particular reference to the large number of horses with records that are descended from a limited number of stallions and to the value of the rigorous selection which is practiced in selecting race horses for breeding.

[Poultry experiments in Canada] (*Canada Expt. Farms Rpt. 1920, pp. 33–35, 49, 50, 122, 123, 132, 181*).—A chick-feeding experiment at the Central Experimental Farm is reported by F. C. Elford (p. 34) and F. T. Shutt (p. 50). Twelve pens were fed and the experiment lasted 5 weeks. The basal ration consisted of cracked corn, wheat, oats, bran, shorts, and corn meal. The pen fed the basal ration alone made the lowest gain and showed the highest mortality, while the highest gains and the fewest deaths occurred in the pens fed meat meal, boiled eggs, and greens, with or without milk. The basal ration

was also greatly improved by the inclusion of any one of these supplements, the most satisfactory being eggs. Other data reported from this station include analyses of eggs, yolks, and whites (pp. 33, 34), a summary of the results of a survey showing the profitableness of poultry farming in different parts of Canada (p. 35), and determinations of the moisture and carbon dioxid content of the air in incubators (p. 49).

At Cap Rouge, Que., G. A. Langelier gives brief reports (p. 122) of studies of commercial grain *v.* screenings, dried clover leaves *v.* roots, skim milk *v.* beef scrap, and snow *v.* water, showing slightly better results with the first named in each case, thus confirming previously noted conclusions (E. S. R., 43, p. 776). In a comparison of methods of preserving eggs also reported from this station (p. 123) only lime water and water glass gave full satisfaction. The other methods tested included wrapping in paper, storing in oats, and storing in sawdust.

A test at Lennoxville, Que., reported by J. A. McClary (p. 132), showed that fattening cockerels for a 3-week period prior to slaughtering was a profitable undertaking.

At Invermere, B. C., a test reported by R. G. Newton (p. 181) gave the following breed averages for number of eggs required for incubation to produce one chick: White Wyandotte 2.7, Barred Plymouth Rock 2.1, and White Leghorn 1.5. In comparing hen eggs and pullet eggs for setting, it was found that 1.8 of the former or 2.3 of the latter were required per hatched chick.

Poultry breeding contest, R. B. Thompson (*Arizona Sta. Circ. 41 (1921), pp. 4*).—This is an announcement and statement of rules of an egg-laying contest to begin November 1, 1921.

The Wyandotte standard and breed book, edited by H. A. Nourse (*[Buffalo]: Amer. Poultry Assoc., [1919], pp. 408, figs. 175*).—This volume consists of descriptions of all varieties of Wyandottes as given in the American Standard of Perfection (1915), and a series of articles on breeding, feeding, housing, conditioning, and exhibiting the Wyandotte fowl.

Inheritance of silkiness in fowls, S. V. H. Jones (*Jour. Heredity, 12 (1921), No. 3, pp. 117–128, figs. 7*).—A hen with silky feathers appeared in a flock of farm poultry of mixed breeding, mainly Brown Leghorn and Rhode Island Red, and was used in inheritance studies at the Wisconsin Experiment Station. Mated to a White Leghorn cock, she produced one cockerel and two pullets, all with normal plumage. The F_2 consisted of 34 normal individuals and 11 silkies, which is as close as possible to a 3:1 ratio. The back cross of an F_1 cock and the original Silky hen gave substantial equality of normal and silky. F_1 birds and extracted silkies of the F_2 were used in matings with purebred Silkies and birds derived from crosses between purebred Silkies and White Leghorns. These matings showed that the factor for silky in the sporadic silky birds and the factor in purbred Silkies are genetically the same.

Examination of the literature and correspondence with poultrymen throughout the country indicated that the sporadic appearance of silkiness in poultry flocks is not uncommon.

A hen which changed color, W. A. Lippincott (*Jour. Heredity, 11 (1920), No. 8, pp. 342–348, figs. 7*).—The case is reported of a blue Andalusian hen that began to acquire white plumage in her third year. A year later she became entirely white. Her breeding record before and after the change was that of a typical Blue Andalusian. When white she was mated to a White Plymouth Rock (recessive white) and produced only black and blue chicks.

The business possibilities of poultry keeping, W. C. Thompson (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 12, pp. 4, fig. 1*).—This is a brief

statement of the advantages of New Jersey for poultry production in respect to soil and climatic conditions and access to markets.

Marketing eggs, J. F. WARE and R. L. SMITH (*Mont. Agr. Col. Ext.* [*Pub.*] *No. 48 (1921), pp. 16, figs. 8*).—Directions are given for candling, grading, and packing eggs, together with the text of the State law regulating the classification and labeling of eggs, notes on exports and seasonal fluctuations in prices, and directions for the organization of cooperative egg-marketing associations.

DAIRY FARMING—DAIRYING.

Soiling v. silage for dairy cows under Nebraska conditions, J. H. FRANDSEN, J. W. HENDRICKSON, G. C. WHITE, A. C. NORTH, and E. G. WOODWARD (*Jour. Dairy Sci., 4 (1921), No. 2, pp. 124–157, figs. 8*).—This is a report of two summers' experiments at the Nebraska Experiment Station in which 4 cows were fed soiling crops and 4 summer silage. The soiling crops consisted of rye and wheat in the early part of the season, oats and peas (grown together) and sweet clover during the middle, and corn, cane, and millet toward the end. No hay was supplied to cows fed the soiling crops, but they had access day and night to the cut crops. The grain ration fed to both lots consisted of corn, bran, and linseed meal (4:2:1).

The comparisons between the two groups of cows in regard to labor and feed required are given in the following table:

Comparison of soiling and summer silage for dairy cows in Nebraska.

Year and method of feeding.	Average weight of cow.	Production of 4 cows.		Feed and labor required per 100 pounds of milk.							Crop area.
		Milk.	Fat.	Labor.	Grain.	Soiling or silage.	Alfalfa hay.	Dry matter.	Crude protein.	Net energy.	
	Lbs.	*Lbs.*	*Lbs.*	*Hrs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Therms.*	*Acres.*
1914 (122 days):											
Soiling	893	10,254	469.3	1.77	47.35	519.9	.....	162.8	15.90	112.4	2.14
Silage	1,014	10,628	413.2	1.21	38.77	153.8	36.6	108.7	10.20	63.8	1.60
1915 (160 days):											
Soiling	1,022	16,708	656.4	1.86	36.27	421.1	.....	137.1	13.23	90.8	2.75
Silage	1,052	11,614	517.2	1.28	41.83	157.7	36.9	112.7	10.74	67.0	1.73

It is concluded that the soiling system is well adapted to conditions in eastern Nebraska, although the summer silage system provides cheaper succulent feed.

Wet and dry feeding of concentrates to dairy cows, R. A. BERRY (*Jour. Agr. Sci.* [*England*], *11 (1921), No. 1, pp. 78–98, figs. 6*).—In two series of experiments at the West of Scotland College of Agriculture, Ayrshire cows were fed in two groups by the reversal method. In both cases there was a tendency for the cows receiving their grain ration in the form of a warm slop to give slightly more milk than those receiving the grain dry. In one series the grain mixture consisted of bean meal, crushed oats, and cotton-seed cake, and in the other of crushed oats, fish meal, milling by-products, and peanut cake. The roughages were swedes, hay, and oat straw. In most of the experiments the supply of drinking water to the cows on dry feed was ample. A heavy ration of swedes (112 lbs.) fed in one of the experiments in conjunction with grain and straw caused a decline in the yield of milk and fat and caused the animals to scour badly.

Experimental feeding of dairy cattle, G. A. LANGELIER (*Canada Expt. Farms Rpt. 1920, p. 118*).—In a calf-feeding project at Cap Rouge, Que., calves fed whole milk until the age of 24 weeks gained 228 lbs. in this time, calves fed skim milk and a home-mixed calf meal gained 219 lbs., and calves fed skim milk and proprietary calf meals gained 168 lbs. The home-mixed meal consisted of corn, oats, and flaxseed (4:2:1).

Data on the feed consumption of dairy heifers are also included.

Unit requirements for producing market milk in eastern Nebraska, J. B. BAIN, G. E. BRAUN, and E. A. GANNON (*U. S. Dept. Agr. Bul. 972 (1921), pp. 16, figs. 2*).—This is a report of the cost of producing milk in Nebraska for the Omaha market during two years, one beginning September, 1917, and the other September, 1919. It is based upon field studies carried out according to the plans followed elsewhere in previous investigations of this series (E. S. R., 45, p. 275). Records were obtained from 21 herds during the first year and 17 herds in the second year. The data cover 494.7 cow years, and the average production was 5,823 lbs. The following table summarizes the average feed and labor requirements for the two years:

Miscellaneous expenditures and amounts of feed and labor expended in producing milk for the Omaha market.

Basis of computation and season.	Mill feed.	Home grown grain.	Legume hay.	Other hay.	Stover and fodder.	Silage, etc.	Human labor.	Horse labor.	Bedding.	Pasture charge.	Miscellaneous costs.[1]
Per cow:	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Lbs.*		
November to April	129	1,082	1,959	183	656	2,749	58.2	1.9	325	$3.18	$23.11
May to October	34	284	1,045	69	363	844	55.4	2.3	15	18.83	23.24
Entire year	163	1,366	3,004	252	1,019	3,593	113.6	4.2	340	22.01	46.35
Per 100 lbs. milk:											
November to April	4.4	36.8	66.7	6.3	22.3	93.6	2.0	.06	11.1	.108	.788
May to October	1.2	9.8	36.2	2.4	12.6	29.3	1.9	.08	.5	.653	.805

[1] Excluding changes in the inventory value of cows.

There were about 244 lbs. of manure saved in the winter and 20 in the summer per 100 lbs. of milk. About 50 per cent of the cows calved between November and April and 43 per cent during the remainder of the year. Feed and bedding totaled 44.3 per cent of the gross cost (including depreciation), pasture 11.7, labor 16.8, depreciation of stock 2.6, and other costs 24.6 per cent. Credits for manure equaled 7.4 per cent of the gross cost and credit for calves 6.2. During the winter 54.3 per cent of the labor was performed by the managers, 26.4 per cent by hired men, and 19.3 per cent by women and children. In the summer the corresponding percentages were 51.1, 21.1, and 27.8, respectively. In the winter 91.7 per cent of the human labor and in the summer 87.1 per cent was used for production as distinct from handling and hauling the milk.

To keep a bull for a year required 823 lbs. of concentrates, 3,749 lbs. of dry roughage, 3,026 lbs. of succulent roughage, 135 lbs. of bedding, and 16.1 hours of human labor besides pasture costs and miscellaneous charges.

The milk situation in Ontario, J. A. RUDDICK (*Jour. Dairy Sci., 4 (1921), No. 2, pp. 114–123*).—The author discusses the economic aspects of milk production in Ontario, and in Canada generally, as influenced by world conditions since the war. The Finch Dairy Station, which is operated on a strictly commercial basis by the Dominion Dairy Branch, is cited as an example of the advantage to the milk producer of having more than one outlet for his product. The station manufactures butter and cheese in proportions controlled by market

conditions, and is prepared whenever prices warrant to ship raw or pasteurized milk and cream, properly cooled, to city markets or to condenseries. It has steadily increased its business, although numerous cheese factories and condenseries have failed.

Official cow testing in Michigan, E. B. HINT (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 19–23*).—This is a summary of official records made in the State in the year 1920–21.

Dairy bacteriology, [S.] ORLA-JENSEN, trans. by P. S. ARUP (*London: J. & A. Churchill, 1921, 2. ed., rev. and enl., pp. XII+180, figs. 70*).—This translation is based on the second Danish edition (1916), but references to a number of more recent researches have been added by the author. The scope of the volume is the same as that of the German edition (E. S. R., 30, p. 677). The translator remarks that "the author has had the unique experience of an intimate knowledge of the highly evolved dairy industries of two countries so widely different as Denmark and Switzerland, and, as the reader will find, he is keenly interested in the valuable work which has been carried out in English-speaking countries, particularly in America."

Acidity and quality, F. W. BOUSKA (*Jour. Dairy Sci., 4 (1921), No. 2, pp. 105–113*).—This is a discussion in which the author upholds the practice of neutralizing cream for butter making.

Neutralization of cream.—Rate and amount of the reaction in flash and batch (or holding) pasteurizers, A. A. RAMSAY (*N. S. Wales Dept. Agr., Sci. Bul. 17, 1920, pp. 22, pls. 2*).—Laboratory and factory experiments are reported continuing the work of O'Callaghan and Ramsay (E. S. R., 43, p. 75).

The mixing of cream and neutralizing agent was more rapid and uniform with the flash method of pasteurization than with the holding method. Wide differences were found in the efficiency of holding plants in actual use in creameries. In using sodium bicarbonate with the flash system there appeared to be a slightly greater reduction in acidity than was expected by theory. On the other hand, the actual reduction in acidity by lime was less than the computed.

Investigation of the influence of temperature on enzyms, particularly rennet and pepsin, A. KÖNIG (*Biochem. Ztschr., 110 (1920), No. 5–6, pp. 266–286, figs. 2*).—In this study of the influence of temperature on the potency of rennet, pepsin, and diastase, the author reports that rennin in dilute aqueous solutions is more susceptible to destruction by heat than is pepsin and concludes that the two are entirely separate enzyms. It is held that milk possesses properties which tend to protect rennet from the destructive action of heat.

On the determination of the efficacy of rennet, H. A. SIRKS (*Dept. Landb., Nijv. en Handel [Nederlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 25 (1921), pp. 83–114*).—The author reports observations indicating that solutions of milk powder are better than fluid milk for testing commercial samples of rennet, owing to the greater stability and the possibility of having a medium of constant chemical composition. Casein solutions were found to be too unstable a substitute.

What is a fair standard for ice cream? R. M. WASHBURN (*Jour. Dairy Sci., 4 (1921), No. 3, pp. 231–239; also in Creamery and Milk Plant Mo., 10 (1921), No. 7, pp. 62, 64, 67, 78*).—The author shows the great diversity in State and municipal requirements as to the minimum fat content of ice cream, and claims that they are in general too high (being based usually on cream standards) to make ice cream a balanced food. A 10 per cent fat standard for vanilla ice cream and an 8 per cent standard for ice creams containing fruit, chocolate, etc., are recommended.

Official grading and control of dairy produce for export, J. A. RUDDICK (*Jour. Dairy Sci., 4 (1921), No. 3, pp. 218–230*).—The author describes the practices of the New Zealand Government in grading all dairy products destined for export, outlines the less complete systems in use in Denmark, Sweden, and Holland, and the noncompulsory inspection service of the U. S. Department of Agriculture, and finally points out the advantages to Canada which would be expected to follow the application of compulsory Government grading to export cheese.

VETERINARY MEDICINE.

Sixth biennial report of the Louisiana State Live Stock Sanitary Board, 1918–1920, E. P. FLOWER (*La. State Live Stock Sanit. Bd. Bien. Rpt., 6 (1919–1920), pp. 117, figs. 12*).—Included in this report are accounts of anthrax or charbon, blackleg, cerebral mycosis, glanders, and hog cholera, and means for their control.

Notes on veterinary pathology in Morocco, 1913–1918, H. VELU (*Laval, France: L. Barnéoud & Co., 1919, pp. 229, figs. 9*).—This is a report of investigations made of diseases of live stock in Morocco, some of the more extensive of which are the following: Trypanosomiasis of horses, a clinical and experimental study (pp. 32–69); equine spirochetes (pp. 74–82); swine pox (91–100); contagious septicemia of swine (pp. 113–120); epizootic lymphangitis, which includes a bibliography of four pages (pp. 132–187); etc.

Annual report of the civil veterinary department, United Provinces, for the year ending March 31, 1920, E. W. OLIVER (*United Provs. [India] Civ. Vet. Dept. Ann. Rpt., 1920, pp. [6]+22, pl. 1*).—The usual annual report (E. S. R., 41, p. 874).

Safeguarding farm stock from disease, M. HENRY (*N. S. Wales Dept. Agr., Farmers' Bul. 137 (1921), pp. 40*).—This is a popular summary of information.

Administration of the meat inspection law by the Bureau of Animal Industry during the war, W. N. NEIL (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 6, pp. 711–714*).

Instructions and interpretations regarding the regulations governing the inspection of meats ([*Ottawa: Canada*] *Dept. Agr., Health Anim. Branch, [1921], pp. 52*).—Data relating to rules and regulations governing inspection of meats are presented.

Animal castration, G. R. WHITE (*Chicago: Amer. Vet. Pub. Co., 1920, 2. ed., rev., pp. [II]+222, pls. 2, figs. 216*).—This is a second, revised edition of the work previously noted (E. S. R., 32, p. 578).

The loco problem, C. D. MARSH (*Producer, 3 (1921), No. 1, pp. 5–8, figs. 3*).—This is a popular discussion of the subject.

Phenol coefficients, F. W. TILLEY (*Amer. Jour. Pub. Health, 11 (1921), No. 6, pp. 513–519*).—The author states that a phenol coefficient indicates relative germicidal efficiency under laboratory conditions only and has no practical value. Users of disinfectants ordinarily follow directions and employ the dilutions recommended by the manufacturers. The author suggests that we make certain that the recommended dilutions are efficient and cast aside the coefficient.

A new method of adding cresol to antitoxins and antiserums, C. KRUMWIEDE and E. J. BANZHAF (*Jour. Infect. Diseases, 28 (1921), No. 4, pp. 367–373*).—A mixture of equal parts of ether and cresol is suggested as a new preservative for antitoxins and serums. It is said to have the advantage over pure cresol of causing a much smaller precipitation at first, of being more strongly antiseptic and of possibly reducing the incidence of adverse reactions.

Some notes on parasitic anaphylaxis, L. H. WRIGHT (*North Amer. Vet., 2 (1921), No. 8, pp. 371–378, 396*).—The author's investigations, here reported, conducted at Reno, Nev., are said to be incomplete, and while no definite conclusions can be drawn several factors have stood out, which he summarizes as follows:

"On autopsy all of the horses were found to harbor Gastrophilus and strongyli except as noted below. The only two animals that have been definitely killed from parasitic anaphylaxis were two horses, bots (*Gastrophilus* spp.) being used. Both of these horses had been used for the production of antihemorrhagic septicemia serum. One on autopsy had no Gastrophilus present, the other had a moderate number.

"The bot material used for the other equine injections was the same or similar to that used for these two, but the animals did not succumb although they were given similar doses and in some cases severe symptoms were shown. This raises the question: What, if any, effect did the use of the animals for serum production have on their subsequent susceptibility to parasitic anaphylaxis?

"Injections of Strongyli material into horses produced anaphylactic shock, but it was less severe than that from *Gastrophilus* spp. There was apparently a tolerance established for the parasitic material, because the subsequent injections produced less severe or no symptoms at all. Apparently the anaphylaxis is specific, in general no symptoms being shown in species other than that from which the parasites were taken.

"In the animals other than horses no positive symptoms were shown. No parasites of any kind were found in any of those autopsied; a few of them, however, were not autopsied. . . .

"From examination of pus as the result of the injection, in general a large percentage of eosinophiles was noted, pointing toward a specific stimulus from the parasitic material. There seems to be a tendency for this specific stimulus to disappear rapidly, and pus cells take the place of the eosinophiles."

Experimental investigations of the biology of the blackleg bacillus, Y. UCHIMURA (*Ztzchr. Hyg. u. Infektionskrank., 92 (1921), No. 2, pp. 291–320*).—This account includes a bibliography of 38 titles.

Bacillus botulinus (type A) associated with fatal pasture disease of horses, R. GRAHAM and H. R. SCHWARZE (*Jour. Infect. Diseases, 29 (1921), No. 2, pp. 114–119*).—"*B. botulinus* type A was isolated from the spleen of a horse that displayed typical symptoms of an endemic syndrome occurring in certain pasture-fed horses in New Jersey. In immunologic tests, as well as cultural examinations, this strain is indistinguishable from *B. botulinus* occurring in olives and spinach, which proved to be the cause of outbreaks of botulism in man. On repeated examination the one sample of hay obtained from a pasture in which the horses had died proved free from *B. botulinus* and other toxic anaerobes. Until the pathogenic and saprophytic characters of *B. botulinus* throughout its cycle in nature are more definitely established, the significance of the type A strain found in the equine spleen is not definitely concluded. In the light of our present knowledge, fortified by clinical evidence in afflicted animals, the bacteriologic findings herein recorded may be diagnostic of equine botulism."

Epizootic lymphangitis, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ., 40 (1921), Spanish ed., pp. 3, 4*).—A brief popular account of this disease, known in Porto Rico as "lamparón" or "mal de botón."

The suceptibility of small experimental animals to foot-and-mouth disease, M. HOBMAIER (*Deut. Med. Wchnschr., 47 (1921), No. 22, pp. 616–618*).—

Guinea pigs, rabbits, rats, and chickens are susceptible to foot-and-mouth disease and suffer from the acute and abortive forms. The incubation period in the guinea pig is usually from 2 to 3 days, extending occasionally to a week or even 12 days.

Concerning a new parasite of "tristeza," J. LIGNIÈRES (*Rev. Soc. Med. Vet. [Buenos Aires], 4 (1919), No. 5, pp. 144–149*).—The small piroplasm described by Quevedo[1] as *Babesia minor* is considered by the author to represent *Piroplasma argentinum*. See also another note by Quevedo (E. S. R., 43, p. 182).

Recovery from rabies, with reports of cases of treatment paralysis and of recovery of animals apparently rabid, J. McI. PHILLIPS, F. BERRY, and J. H. SNOOK (*Jour. Infect. Diseases, 29 (1921), No. 1, pp. 97–108*).—"Spontaneous recovery from rabies naturally acquired, while rare, does occur. The saliva of an animal which recovers from rabies may have been extremely virulent during the course of the disease. As early as 38 days after recovery from street rabies in a dog, the infectivity of the brain may disappear and Negri bodies be absent. Therapeutic measures to control the symptoms in developed rabies in man should not be so heroic as to themselves endanger the life of the patient, for there is a possibility of recovery."

Blood transfusion in the hyperimmunization of cattle against rinderpest, R. SACEGHEM (*Compt. Rend. Soc. Biol. [Paris], 85 (1921), No. 20, pp. 12, 13*).—The author claims to have had good results in the hyperimmunization of cattle against rinderpest by the direct transfusion of blood from an infected animal into the animal to be immunized. The animals thus hyperimmunized are said to furnish a serum superior to that obtained by the customary methods.

Testing of antistreptococcus serum, E. M. A. ENLOWS (*Amer. Jour. Pub. Health, 11 (1921), No. 8, pp. 733–738*).—This contribution from the U. S. Public Health Service reports the results of a few experiments made to determine the protective properties of antistreptococcus serums against certain types of *Streptococcus hemolyticus*. It is pointed out that a satisfactory method for the sandardization of such serums is rendered difficult by the present unsatisfactory classification of the streptococci and the uncertainty of etiological connection of any species or group with a particular pathological process.

A comparison of monovalent serums obtained by the immunization of rabbits with different strains of streptococci and various commercial serums showed that it is possible to obtain serums of higher protective properties than the majorty of those now being produced. It is suggested that more potent serums would probably be obtained if they were not produced by the injection of such a large number of heterogeneous types.

A serum prepared by the immunization of chickens by intraperitoneal inoculation of heated cultures of three homologous strains of *S. hemolyticus* was found to give no greater protection against homologous types of hemolytic streptococci than was afforded by a polyvalent horse serum prepared by E. K. Tingley. Serums prepared from toxic filtrates of streptococci according to the method suggested by Clark and Felton (E. S. R., 40, p. 83), proved to have no protective value.

Tick paralysis, S. DODD (*Agr. Gaz. N. S. Wales, 32 (1921), Nos. 4, pp. 265–272; 5, pp. 331–337*).—Experiments reported confirm the popular belief that one of the so-called scrub ticks, namely, *Ixodes holocyclus*, is capable of producing a very fatal affection in animals, the main feature of which is a progressive motor paralysis. A bibliography of 11 titles is included.

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[1] Rev. Soc. Med. Vet. [Buenos Aires], 3 (1918), No. 14, pp. 504–509.

Policies of the Bureau of Animal Industry in cooperative tuberculosis eradication work, J. A. KIERNAN (*North Amer. Vet., 2 (1921), No. 8, pp. 358–364*).

Chaulmoogra oil in the treatment of tuberculosis, W. L. CULPEPPER and M. ABLESON (*Jour. Lab. and Clin. Med., 6 (1921), No. 8, pp. 415–426, figs. 4*).—This is a preliminary report of an investigation of the action of chaulmoogra oil in experimental tuberculosis, the scope of the work including an investigation of the most satisfactory fraction of the oil and the most effective method of administration, the possible pathological effects of large doses of the oil, the bactericidal properties for tubercle bacilli in vitro, and the effect of administration under the most favorable conditions on the development of artificially induced tuberculosis in guinea pigs.

One per cent solutions of the soluble acid sodium salt of the four acid fractions of chaulmoogra oil, prepared by the method of Hollman and Dean,[1] as modified by T. B. Aldrich, were apparently the most active and least irritating when administered intraperitoneally. The salts in this concentration were found to be not only nontoxic but to cause a marked increase in the rate of growth of the experimental guinea pigs. The salts showed specific bactericidal action on tubercle bacilli in dilutions up to 1:10,000. Of 12 animals inoculated with virulent human tubercle bacilli and not treated all died except 1, and of 12 treated animals only 1 died.

Therapeutic value of chaulmoogra oil and its derivatives in experimental tuberculosis, C. VOEGTLIN, M. I. SMITH, and J. M. JOHNSON (*Jour. Amer. Med. Assoc., 77 (1921), No. 13, pp. 1017–1020, figs. 3*).—An exhaustive test of the value of chaulmoogra oil and its derivatives in the experimental tuberculosis of guinea pigs is reported with unfavorable results.

Three series of animals including, with controls, from 85 to 149 animals each were used. The first series received an initial inoculation of 0.001 mg. and the other two 1 mg. of human tubercle bacilli emulsion. The subsequent treatment consisted of the intravenous injection of sodium chaulmoograte, ethyl chaulmoograte in olive oil, chaulmoogra oil, and iodin-saturated ethyl chaulmoograte in varying doses. In no case did the treatment have any favorable effect on the mortality rate, growth curves, and extent of lesions found at necropsy of the experimental animals.

Epidermoid carcinoma in domesticated animals, S. A. GOLDBERG (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 170–180, pls. 5*).—The author concludes that in the domestic animals the epidermoid carcinomata are the most common of the malignant epithelial tumors, and that epidermoid carcinoma originates more frequently at the places of transition between the skin and modified squamous epithelium, or between squamous and other types of epithelium.

Studies on the normal blood of the domesticated animals, C. E. HAYDEN and M. TUBANGUI (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 181–192*).—"The Folin and Wu method has the marked advantage in the initial preparation of a protein-free filtrate from a small sample of blood. The filtrate enables the laboratory worker to test for all of the extractives noted by the use of one sample. The system offers a rather simple and easily applied method for blood analysis.

"Our results for total nonprotein nitrogen do not vary greatly when compared with others noted. The lowest average is 31 mg. per 100 cc. of blood from cattle. The highest average is 35 mg. in the blood of swine. The variations in our results are no more marked than those obtained as between other workers.

[1] Jour. Cutaneous Diseases, 37 (1919), No. 6, pp. 367–386.

"The average for urea in cattle is 18.8 mg. per 100 cc. of blood; horse 17.8, sheep 17.8, and swine 19.6. It is to be expected that the urea readings would be higher in the blood of omnivorous than in herbivorous animals. On the whole it has been so proven in the hands of other laboratory workers. While our uric acid readings are many times higher than those quoted, we feel that they do not vary far from the actual quantities. It is to be remembered that all of these readings for any substance noted in our results have been made using whole oxalated blood.

"Results for creatin have been rather stable when compared with other averages. We find the average for cattle to be 1.84 mg. per 100 cc. of blood; horse 1.8, sheep 1.26, swine 1.42.

"Sugar values for the cow have averaged 96 per 100 cc. of blood; horse 106, sheep 105, swine 97.1. The percentage in any of these animals seems to us to be within the limits of expectation."

A preliminary study of the normal variation in the temperature of cattle, E. A. Hewitt (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 544–548*).—The author concludes that the normal range of variation in the temperature of cattle is somewhat higher than is usually given, there being a range of 4.4° F. in extreme cases. The average normal temperature was found to be around 101°. There are differences in individuals in their daily variation. Water, if given cattle at accustomed times and quantities, usually causes little variation in the temperature.

Researches upon the diseases of breeding cattle, W. L. Williams (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 55–66*).—This paper deals with tubal infections, the genital infections of bulls, and the influence of intrauterine infections of the fetus upon the temperature of new-born calves.

The bacterial content of the genital tract of cattle, and its relation to calf infection, C. M. Carpenter (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 6, pp. 676–683*).—This is a report of bacteriological studies of the female genital tract of cattle.

The diseases of the oviduct of the cow and their relation to sterility, H. L. Gilman (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 128–154, pls. 9*).—The author's investigations have led him to conclude that "streptococcic salpingitis with or without atresia of the lumen is apparently quite common in herds in which sterility and abortion are present. Its relation to the production of sterility seems to be very important in many cases. This form of salpingitis is not recognizable on clinical examination, except when accompanied by a perisalpingitis with the formation of connective tissue strands on the mesosalpinx. It is suggested that the tube may harbor organisms which, if pregnancy takes place, may be directly or indirectly associated with abortion."

The sterility of cattle, its recognition and treatment, E. Hess (*Die Sterilität des Rindes, ihre Erkennung und Behandlung. Hanover: M. & H. Schaper, 1920, pp. 177, figs. 36*).—This work deals with the anatomy of the ovaries (pp. 7–16), cystic degeneration of the ovaries (pp. 16–152), pyometria (pp. 156–166), enucleation of the corpus luteum (pp. 166–170), and hypertrophy of the corpus luteum (pp. 170–174). A bibliography is included (pp. 175–177).

A study of an unusual case of sterility in a young heifer, W. L. Boyd and D. C. Beaver (*North Amer. Vet., 2 (1921), No. 2, pp. 75–79*).—The study here reported in detail has been summarized as follows:

"*Bacillus pyogenes* seems to be the most virulent of the organisms present, and responsible for the chronic changes observed. This appears logical to us, for *B. pyogenes* has never been observed in our studies on sterility except in purulent inflammations of the genitalia, and appears to be almost always present under such conditions.

"The chronic changes described include: First, abscess in right ovary; second, cyst in left ovary; third, adhesions about ovaries, bringing them closely in contact with the uterus; fourth, purulent salpingitis; fifth, pyometra; sixth, atrophy and cystic degeneration of many uterine glands. This combination of conditions justifies the diagnosis of incurable sterility."

Infectious abortion studies, B. T. SIMMS and F. W. MILLER (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 532–535*).—The results obtained by the authors at the Oregon Experiment Station lead them to recommend the following measures for control and eradication of the disease:

"Abortion-free herds may be built up from abortion-infected herds by adopting methods of herd management which will prevent exposure of heifers after they reach sexual maturity. Testing all cattle and eliminating the reactors will certainly tend to control and possibly eradicate abortion. The most common method of spread is through exposure of cows and pregnant heifers to infected cows and premises. Cattle owners should protect their herds by not allowing exposure to any sexually mature cows unless it is known that these animals are free from the disease. In buying females to be added to the herd, young unbred heifers should be preferred."

The herd restraint of abortion disease in cattle, J. P. TURNER (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 536–542*).—This is a report of observations made in a herd of 200 cows and 50 heifers, covering the period since the year 1900. The results lead the author to consider it necessary to discontinue the purchase of susceptible cows for aborting herds and depend upon bulls to raise the herd milk standard. In this manner a herd immunity is established.

"Loin disease" or lumbar paralysis, A. T. KINSLEY (*Vet. Med., 16 (1921), No. 7, pp. 24–30, figs. 9*).—Loin disease is the name of a condition or disease of cattle occurring in the central region of Texas. It is characterized in the beginning by disturbances of locomotion. The affected animals soon go down and remain in the decubital position until death. Typical cases of this affection are said, on apparently reliable information, to have occurred in 1900 or earlier, although it is maintained by some that the disease first appeared in 1918 or 1919. The affection is more or less prevalent in the coastal region of Texas and is reported to extend for at least 100 miles inland. The course of the disease varies from 24 hours to 4 or 5 days in the majority of cases. Some few cases will live for 20 days or even longer, and a very small percentage recover. The cause of the disease had not as yet been determined.

A study of the morphology of Piroplasma (Gonderia) mutans of cattle, E. SERGENT (*Ann. Inst. Pasteur, 35 (1921), No. 3, pp. 193–203, pl. 1*).—This report of studies of *P. mutans* includes a bibliography of 37 titles.

Bovine coccidiosis in British Columbia, with a description of the parasite Eimeria canadensis n. sp., E. A. BRUCE (*Jour. Amer. Med. Assoc., 58 (1921), No. 6, pp. 638–662, figs. 54*).—"A dysentery due to coccidia has been affecting range cattle of all ages in British Columbia. It occurs in the dry interior of the province and usually in the winter. Out of 165 visibly affected animals 50 died (30 per cent). Young animals suffer the most severely. Fatal cases die usually in from 2 to 5 days after showing symptoms, and within 24 hours of death are subject to fits of not more than a minute's duration, death being in convulsions. The principal lesions are confined to the rectum of older animals and to the small intestine of young calves.

"The following treatment was found effective in controlling the disease: 50 lbs. of a mixture consisting of sulphur 2 parts, sulphate of iron 2 parts, salt 6 parts, was mixed with 100 lbs. of linseed oil-cake meal, and was fed in troughs to 100 head per day for two weeks.

"The coccidium responsible shows several differences from available accounts of *E. zurni*, and also differs from coccidia of New Jersey calves reported by Smith and Graybill of the Rockefeller Institute [E. S. R., 40, p. 185]. The name *E. canadensis* is proposed.

"Symptoms develop in 14 days after the ingestion of infective oöcysts. It is apparently only pathogenic for cattle. Oöcysts may be infective within 3 days of being passed, and have been infective after 13 months when kept under adverse conditions in the laboratory. Infected ground should be treated with some form of lime and then deeply ploughed."

A list is given of 17 references to the literature.

Verminous bronchitis of calves, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Circ. 38 (1921), Spanish ed., pp. 7, figs. 2*).—A brief popular account of this parasitic affection.

A study of an organism from nephritis in sheep, C. P. Fitch and D. C. Beaver (*Jour. Infect. Diseases, 28 (1921), No. 4, pp. 345–351*).—"An organism for which we propose the name *Bacterium nephritidis ovis* has been isolated from three cases of ovine nephritis. Two strains of this organism have slightly different P_H values in various carbohydrate mediums. Further experiments are necessary before the channel of infection of this organism can be told with certainty. This organism is nonpathogenic for guinea pigs and rabbits. Apparently a somewhat close relationship exists between the organism here described and *Bacillus nephritidis equi* Meyer. The serologic investigations do not yet permit positive conclusions."

[Occurrence of stomach worms of sheep], E. M. Straight (*Canada Expt. Farms Rpt. 1920, p. 145*).—The stomach worm (*Strongylus contortus*) was a source of great loss to spring lambs in the vicinity of Morden, Man., during the spring and summer of 1919, many farmers in the district losing practically all their lambs. A post-mortem examination made of two that were lost at the station farm showed the presence of *S. contortus* in very large numbers and of *Taenia expansa* in medium numbers. By starving the lambs for a period of 24 hours and then administering a drench consisting of 1 tablespoonful of gasoline, 5 to 6 oz. of fresh cow's milk, and 1 tablespoonful of raw linseed oil, thoroughly mixed, quite satisfactory results were obtained, and it was not found necessary to repeat the dose.

The course that surra runs in camels when naturally contracted and when artificially inoculated, H. E. Cross (*Agr. Research Inst. Pusa Bul. 98 (1921), pp. 19, pls. 3*).—The studies reported show a high mortality to follow when camels are naturally infected with surra.

The course that camel surra runs in ponies, buffaloes, and other animals, H. E. Cross (*Agr. Research Inst. Pusa Bul. 99 (1921), pp. 19, pl. 1*).—The details of investigations conducted are reported.

Field and laboratory diagnosis of swine diseases, W. W. Dimock (*North Amer. Vet., 2 (1921), No. 3, pp. 123–127*).—The author here reports briefly upon 20 herds of swine with which the Kentucky Experiment Station was called upon to assist in diagnosis and recommend treatment and preventive measures.

Internal parasites of the hog, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Circ. 36 (1921), Spanish ed., pp. 3–9, figs. 6*).—This is a brief account of internal parasites of the hog in Porto Rico.

Pulmonary ascariasis in young pigs, H. B. Raffensperger (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 592–595*).—Observations were made of a herd at Bushnell, Ill., in which 93 pigs farrowed in September were reduced by death to 55 by October 8, of which only 24 appeared normal, the others being affected with thumps. In post-mortem examinations of two, ascarids were

found in the lungs of both, seven larvae being present in one microscopic preparation made from a few drops of mucus taken from the right bronchus of one of the pigs. The evidence that the losses among the pigs on this farm were the result of pulmonary ascariasis is very clear from the post-mortem examinations.

A plan of managing young pigs to avoid losses from ascarids is presented.

The tapeworm of swine, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 37 (1921), Spanish ed., pp. 5–7, fig. 1*).—This is a brief account of the pork tapeworm.

The bacillus of swine erysipelas isolated from urticarial lesions of swine in the United States, G. T. CREECH (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 2, pp. 139–150, fig. 1*).—It is pointed out that urticaria or "diamond skin disease" in Europe is caused by *Bacillus erysipelatis suis* or rotlauf bacillus, the invading organisms in this mild form being no doubt very much attenuated. The failure to infect healthy pigs with cultures obtained from the chronic type of lesions, which are otherwise typical of *B. erysipelatis suis*, should not, in the author's opinion, be taken as evidence that such organisms are not a true type of the erysipelas bacillus. The evidence obtained relative to the organisms isolated from urticarial lesions of swine in the five different cases described in the present account is considered sufficient to warrant the conclusion that these organisms are a type of *B. erysipelatis suis*, and that the disease urticaria or diamond skin disease now existing in the United States should in the future be classified as a chronic form of swine erysipelas, just as it has been heretofore in European countries.

African horse sickness (Pestis equorum), A. THEILER (*Union So. Africa Dept. Agr., Sci. Bul. 19 (1921), pp. 32*).—This is a summary of information on African horse sickness.

On the etiology of enzootic meningo-encephalitis (Borna disease) of equines, R. KRAUS, L. KANTOR, and R. QUIROGA (*Rev. Soc. Med. Vet. [Buenos Aires], 5 (1920), No. 3, pp. 122–143, pls. 31*).—This paper has been noted from another source (E. S. R., 44, p. 280).

A bacteriological study of abscess of the feet of hens, B. F. KAUPP (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 2, pp. 218–226, fig. 1*).—In investigations of abscesses of the feet of White Leghorn hens made at the North Carolina Experiment Station, the author isolated *Staphylococcus pyogenes aureus* in pure culture from all cases.

A study of cloacitis in the domestic fowl, S. A. GOLDBERG and J. P. BENSON (*N. Y. State Vet. Col. Rpt., 1919–20, pp. 203–222*).—Data here presented have been noted from another source (E. S. R., 44, p. 881).

Studies on the development of Ascaridia perspicillum, parasitic in fowls, J. E. ACKERT (*Abs. in Anat. Rec., 17 (1920), No. 5, pp. 331, 332*).—In studies in Kansas, 100 out of 424 local fowls examined were found to be infested by *A. perspicillum*, 30 or more worms usually having a visible effect upon the fowl and frequently causing its death. Within 28 hours after ingestion of eggs containing motile larvae the fowl's small intestine becomes filled with the young active nematodes, which besides breaking through the shell have increased their length 25 per cent. The larvae double their length in 3 days and are nearly half grown in 30 days. A single larva is said to have been found in the lung and one in the trachea.

"That the ova of this species are somewhat resistant to extremes of humidity and temperature is indicated by their continuous development through at least 7 days' exposure to the sun in June and July at temperatures of 23 to 33° C. and by their ability to endure 15 hours of continuous freezing at temperatures between 11.6 and −8°."

Coccidia as a cause of quail disease, B. A. GALLAGHER (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 1, pp. 85–88*).—The author concludes, from the study of quail disease here reported, that the coccidium must be considered as a causative agent.

"This evidence is supported by the fact that lesions of a similar necrotic nature are found in coccidial and other protozoan infections, such as coccidiosis of the liver of rabbits and young chicks and enterohepatitis of turkeys. The experiments, while not sufficiently numerous to warrant elimination of the colon bacillus as another causative factor, showed that quail disease could be induced by allowing birds to consume material containing coccidia, whereas the injection or feeding of *B. coli* isolated from a case of quail disease failed to reproduce the disease. The finding of *B. coli* outside the intestinal tract and especially in the liver of birds dead of quail disease is not of sufficient weight to give it primary etiological importance. This is particularly true in view of the absence of experimental proof that *B. coli* is capable in itself of inducing a case of this disease."

RURAL ENGINEERING.

Elements of engineering geology, H. RIES and T. L. WATSON (*New York: John Wiley & Sons, Inc., 1921, pp. V+365, pls. 3, figs. 249*).—The aim of this book is to emphasize the practical application of the geological subjects treated to engineering work. It contains chapters on the important rock-making minerals; rocks and their relations to engineering work; structural features and metamorphism; rock-weathering and soils; development work, and control of rivers; underground water; landslides, land subsidence, and their effects; relation of wave action and shore currents to coasts and harbors; origin and relation of lakes and swamps to engineering work; origin, structure, and economic importance of glacial deposits; road foundations and road materials; and ore deposits; and an appendix on geologic column.

Hydraulics with working tables, E. S. BELLASIS (*London: Chapman & Hall, Ltd.; New York: D. Van Nostrand Co., 1920, 3. ed., pp. VIII+348, figs. 186*).—In the third edition of this book the object has been to cover the facts, laws, and principles of hydraulics, always keeping their practical aspects in view. Chapters are included on general principles and formulas, orifices, weirs, pipes, open channels—uniform flow, open channels—variable flow, hydraulic observations, unsteady flow, and dynamic effect of flowing water. Some description of hydraulic field work is included.

Surface water supply of the United States, 1917.—IX, Colorado River Basin. X, The Great Basin (*U. S. Geol. Survey, Water-Supply Papers 459 (1921), pp. 192+XXXIII, pls. 2; 460 (1921), pp. 277+XL, pls. 2*).—The first of these papers, prepared in cooperation with the States of Arizona, Nevada, Utah, and Wyoming, presents the results of measurements of flow made on streams of the Colorado River Basin during the year ended September 30, 1917. The second, prepared in cooperation with the States of Utah, Nevada, California, Oregon, and Wyoming, presents results of corresponding measurements of flow made in the Great Basin.

Third report on the water powers of Georgia, B. M. and M. R. HALL (*Ga. Geol. Survey Bul. 38 (1921), pp. VIII+316, pls. 15*).—This report describes the developed water powers of the State of Georgia, and presents the results of measurements of flow made on six major drainage basins of the State, largely in cooperation with the U. S. Geological Survey.

General and special irrigation laws of the State of Texas (*Austin: State, 1920, pp. 103*).—The text of these laws is given, as compiled by the Board of Water Engineers.

Data for estimating cost of tile drains (*Engin. and Contract., 56 (1921), No. 6, p. 124*).—Tabular data for use in estimating the cost of digging trench, laying tile, backfilling, and hauling tile for drainage districts are presented. These are applicable to northern Iowa and southern Minnesota.

The "Buckeye" ditcher for land drainage.—Trial in Cambridgeshire, H. V. GARNER (*Jour. Min. Agr. [London], 28 (1921), No. 4, pp. 306–320, pls. 2*).—A series of tests with a tractor ditcher designed on the rotating bucket wheel system is described. The machine used was fitted with a 20 H. P., 4-cylinder gas engine and a digging wheel capable of digging a trench 14.5 in. wide and 5.5 ft. deep. The purpose was to determine the value of mechanical drainage trenching on English soils. The soils encountered were a stiff bowlder clay containing a few large bowlders and bands of chalk pebbles and in places uniform sticky clay. The work was conducted in bare fallow soil and on wheat stubble. The fuel used was benzol and second grade petrol.

It was found that the drainer could operate more rapidly at any given depth in a dry clay subsoil containing chalk and gravel than in a wet subsoil. The rate of excavation measured in chains per hour increased rapidly as the trench became shallow on the same type of soil. The cost of shallow drains was very much less than that of deep ones. Drains 3.5 ft. deep in dry clay cost exactly three times as much to dig as 2-ft. drains in similar soil. The drainer was capable of excavating straight trenches to any depth not exceeding 4.5 feet. It was not successful in excavating trenches with a curve approximating a right angle. The trenches were excavated at varying speeds, according to the depth and moisture of the subsoil. Drains 3.5 ft. deep in moist clay were dug at the rate of 1.7 chains per hour and in dry clay at the rate of 3 chains per hour. Drains 2 ft. deep were dug in dry clay at the rate of 9 chains per hour.

In the experiment the costs of working were high owing to the conditions of operation. A conservative estimate of the cost of operation under commercial conditions is thought to compare favorably with present costs of hand digging.

The trial showed that the friction produced by the revolution of the digging wheel in moist clay greatly retarded the speed of work and increased the cost. This friction was chiefly between the outside rims of the wheel and the sides of the trench. It is recommended that scrapers be fixed to the framework and adjusted to remove the adhering clay from the sides of the wheel to obviate friction.

It is further concluded that if the machine were fitted with a wheel and buckets capable of digging trenches a maximum of 11 in. and a minimum of 8 in. wide instead of respective maximum and minimum widths of 14.5 in. and 11.5 in., considerable economy in operation costs might be expected. The consumption of fuel calculated from the daily figures of the whole trial averaged $2\frac{1}{3}$ gal. of benzol and $\frac{2}{5}$ gal. of cylinder oil per running hour.

Use of poison in maintenance work on drainage canals, O. C. KULICKA (*Engin. News-Rec., 87 (1921), No. 8, pp. 322, 323*).—Experiments on the prevention of stump sprouting in the drainage channels of the Riverside and Bogue Phalia drainage districts in Mississippi indicated that the most effective treatment consisted of cutting the trees and bushes in the channels about 6 in. from the ground surface and poisoning the stumps with a preparation of granulated caustic soda and white arsenic. In a suitable vessel containing 8 gal. of water 10 lbs. of caustic soda are poured, and as soon as the water begins to steam from its action upon the soda, 10 lbs. of white arsenic are added and dissolved by

vigorous stirring with a wooden paddle until the mixture cools. Two gallons of water are then added and the compound is ready for use.

The best results were obtained by splitting the stumps with an ax, brush hook, or machete, and applying the poison on the fresh cuts with mops made of old sacks tied to sticks about 24 in. long.

Clearing bush lands in British Columbia, C. E. HOPE (*Brit. Columbia Dept. Agr. Bul. 85 (1920), pp. 43, figs. 21*).—This is the third revised edition of this bulletin, describing various clearing operations adapted to the bush lands of the coast and Lower Fraser Valley districts of British Columbia and to those parts of the province lying west of the Cascade Mountains. The methods described include blasting, char pitting, the use of stumping machines, and the use of acid. The so-called acid methods of stumping are said to be unsuccessful.

The use of explosives in agriculture, C. ULPIANI, L. CESARONI, and A. GENTILE (*Pub. Staz. Agr. Sper. Bari, 1 (1919), No. 1, pp. 32*).—This report deals with the use of surplus war explosives in Italy for the blasting and clearing of rocky soils and for tree planting.

Experiments conducted at the Bari Experiment Station with ballistite, solenite, cordite, picric acid, and nitrocellulose are described. The conclusion is drawn that these explosives may be profitably used for the planting of orchards and vineyards in rocky and hilly regions, but not on meadows and pastures.

Illinois begins traffic endurance test, C. OLDER (*Engin. News-Rec., 87 (1921), No. 7, pp. 274–276*).—The structural details are described of a 2-mile road which consists of 63 different kinds of pavement to be tested to destruction by progressively increasing truck loads.

Standard and tentative methods of sampling and testing highway materials (*U. S. Dept. Agr. Bul. 949 (1921), pp. 98, pl. 1, figs. 37*).—Standard methods of sampling and testing the materials employed in highway construction, as recommended and adopted by the second conference of State highway testing engineers and chemists at Washington, D. C., February 23–27, 1920, are set forth in this bulletin. These include tests for both bituminous and nonbituminous road materials and tentative tests, as well as forms for recording and reprinting results. It is noted that the standard methods adopted by the American Society for Testing Materials have been accepted so far as the field has been covered by the society.

Effect of age on the strength of concrete, D. A. ABRAMS (*Concrete [Detroit], 18 (1921), No. 1, pp. 14, 15, figs. 2*).—The author reviews considerable data on the effect of age on the strength of concrete in roads, and concludes that in roads where the concrete may receive moisture from the subgrade and from seasonal rains and snows, a gradual ascent in the age-strength curve for an indefinite period of years may be expected. There is no reason to anticipate a reduction in strength with age under normal conditions even in arid regions.

Powder-post damage to timber and wood products, A. D. HOPKINS and T. E. SNYDER (*Engin. News-Rec., 87 (1921), No. 7, pp. 269–271, figs. 3*).—In a contribution from the U. S. Department of Agriculture the nature of the extensive injury by powder-post beetles to seasoned hardwood material of all kinds, finished and unfinished, is explained, and methods of control and prevention are outlined.

The injury is caused by grubs which are the larvae of small beetles. These grubs, yellowish white in color and from $\frac{1}{8}$ to $\frac{1}{4}$ in. long, burrow through the wood in all directions and convert it into powder, finally boring to the surface for the escape of the beetles. Seasoned heartwood and sapwood of both hardwood and softwood trees are attacked by different kinds of these beetles, but it is stated that by far the larger proportion of this kind of trouble is caused to the seasoned sapwood of hardwood by species of the genus Lyctus.

In the reclamation of infested wood all infested material, including sap edges of lumber and all refuse of sapwood, should be sorted out and disposed of. Material showing the slightest evidence of powder-post damage should be destroyed. This work should be done between October and March in storehouses and before April in the open air. For the more valuable stock the wood should be treated for the destruction of the insects between October and March. Pure kerosene oil may be applied with a brush or rag, or the wood may be immersed in kerosene. Hot mixtures of creosote and kerosene oil and of creosote and naphtha have also been used successfully when applied by immersion or brushing. Thorough steaming of the infested wood in the dry kiln is said to be effective, the seasoned wood being heated to temperatures up to 200° F. for a short period after the usual kiln-drying operation. The damaged woodwork of buildings should also be treated with kerosene.

As preventive measures, it is stated that stock which has been seasoned longer than eight months and is to be held in storage may be rendered immune by applying two coats of hot boiled linseed oil, or by immersing it in hot oil. This treatment should be given between October and March.

Strength of bolts in timber, H. J. FINEBAUM (*Engin. and Contract., 56 (1921), No. 4, pp. 77, 78, figs. 5*).—Mathematical formulas giving working values for bolted joints are derived, and a diagram giving the strength of bolts in timber is presented.

The diagram shows values for the theoretical bearing length of bolts in inches, bolt diameters, bending strengths of bolts in timber, and unit compressive stresses in timber. The two following formulas for the working values of bolted joints are presented:

$$P=\frac{d^2}{4}\sqrt{15\pi f_s f_w} \qquad L=\frac{d}{2}\sqrt{\frac{3\pi f_s}{5f_w}}$$

in which f_w=unit fiber stress in timber, f_s=unit fiber stress of steel in flexure, P=value of the bolt or the load on the bolt, t=thickness of the timber, d=diameter of the bolt, L=thickness of timber assumed as under compressive stress due to P. Note: Where $L<t$, values of P hold; where $L>t$, values of bolt in bearing hold=$\frac{5}{8}\ dtf_w$.

Tractor pulley widths and speeds (*Extr. Jour. Soc. Automotive Engin., 9 (1921), No. 1, p. 53*).—The substance of the report of a committee investigating tractor pulley widths and speeds presented at the farm power meeting of the Society of Automotive Engineers at Columbus, Ohio, February 10, 1921, is reported.

Speeds of 1,500, 2,600, 3,000, and 3,500 ft. per minute were approved by the committee. It was recommended to designers of pulleys and clutches for new equipment that the minimum diameter be 12 in. and that the pulley width be not less than ½ in. wider than the belt required.

It was also recommended that a governor be considered a necessary part of a farm tractor that is used for belt operations, and it was suggested that some means should be provided on tractors for the attachment of a suitable speed-indicating device.

What we learned about thrasher explosions, H. E. ROETHE (*Amer. Thresherman and Farm Power, 24 (1921), No. 3, pp. 12, 47, figs. 2*).—In a contribution from the U. S. Department of Agriculture, the general results of studies on the causes of and remedies for thrasher explosions, particularly in the State of Washington, are presented and discussed. Most of these have been noted from other sources.

In connection with this work special studies were conducted in the field on the accumulation and redistribution of static electricity in thrashing machines.

The electrical equipment consisted of a voltmeter and a spheregap, used to measure voltage, and a galvonometer to determine differences in potential. A maximum of 60,000 volts was found on main drive belts. A few hundred volts were recorded in several cases on cylinder shafts, and strong shocks were received on numerous occasions from grain pans and from metallic discharge pipes attached to special dust-collecting fans.

There was a continual marked difference in potential between the earth and the different parts of the separators. Several steel machines showed, as individual units, a greater potential than the earth, every part being positively electrified. In many machines a marked difference in potential was found between the cylinder shaft and concaves, the concaves and the main frame, and between the grain pan and the main frame. This was taken to indicate that under favorable conditions the cylinder, concaves, and grain pan would become electrified to a greater extent than other parts of the machine, resulting in the occurrence of a spark during the restoration of the normal static balance.

A state of electrification existed not only upon metallic pipes through which air laden with smut or grain dust passed, but also upon metallic surfaces in contact with passing straw or grain.

Lightning rods—their value, and practical plans for installation, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 16–19, fig. 1*).—Brief general directions for the installation of lightning rods on farm buildings are given, together with diagrammatic illustrations.

RURAL ECONOMICS AND SOCIOLOGY.

International Institute of Agriculture at Rome (*U. S. House Represent., 67. Cong., 1. Sess., Com. Agr. Hearings on Internatl. Inst. Agr. Rome, Serial A, 1921, pp. 14*).—The statement by O. R. Agresti before the House Committee on Agriculture in regard to the International Institute of Agriculture, together with a list of countries and delegates represented on the permanent committee of this institution in April, 1921, and of the staff of its bureau of general statistics, is published here.

Reports and studies carried on in the Bureau of Rural Economics and Statistics, E. LAHITTE (In *Informes y Estudios de la Dirección de Economia Rural y Estadística. Buenos Aires: Min. Agr. Nac., 1920, vol. 3, pp. 3–53, 125–308*).—A number of studies relating to economic problems of agriculture in Argentina are published here, namely: Sales, loans, and subdivision of rural property in 1905, 1910, 1915, and 1916 (pp. 3–43); the economic situation, value of the national production in 1912–13 (pp. 44–53); conditions necessary for the development of milk production in Argentina (pp. 125–206); the question of roads (pp. 207–218); the National Society for Agricultural Protection (pp. 219–227); the Society for Agricultural Insurance (pp. 228–241); Argentina's economic problems (pp. 242–293); the development of national industry (pp. 294–299); and investigations of the question of postwar immigration (pp. 300–308).

The control of farm management and some fundamental principles in agricultural costing, C. S. ORWIN (*Jour. Min. Agr. [London], 28 (1921), No. 3, pp. 225–231*).—Several phases of farm account keeping as a test of the management of the business are discussed here, including the basis for valuation, the distribution of rent, the charge for interest, and the charge for management.

Simple cost accounts for farmers, A. D. HALL (*Jour. Min. Agr. [London], 28 (1921), No. 3, pp. 216–224*).—Suggestions are offered as to making an initial valuation and keeping a series of working accounts.

The profits from the application of chemical fertilizers at present prices and their importance in connection with food production, O. LEMMERMANN and K. ECKL (*Mitt. Deut. Landw. Gesell., 36 (1921), Nos. 11, pp. 177–183; 12, pp. 201–207*).—The aim of this study is to show in how far, under the present price conditions, the application of artificial, especially nitrogenous, fertilizers may be profitable. Experiments carried out on a number of crops in 1919 and 1920 at the experiment station for the Province of Brandenburg, Germany, are described, and the costs and profits analyzed.

Increased yields with greater profits resulted in the case of each of the crops experimented with. It is indicated that the use of fertilizers would be more profitable were it possible for the average farmer to know exactly the amount of phosphoric acid required by a particular soil in addition to the nitrogenous fertilizers used. The economic importance of a cheaper and more abundant supply of phosphoric acid is pointed out.

Results of the business on a rented farm in Mecklenburg through 58 years and the significance to the private individual and to the public of intensive agriculture in times of war and peace, H. HOPPENRATH (*Landw. Jahrb., 51 (1917), pp. 71–92, pl. 1*).—A detailed study is made of the business of a certain farm near a direct railroad line to Berlin. Its history is considered in three periods which are distinctive as to methods of farming, especially as to the degree of intensity of the farming business, the first including the years 1856 to 1871, the second 1872–73 to 1892–93, and the third 1893–94 to 1913–14. Increases in the amount of capital invested, machinery used, and other intensive factors are pointed out. With this example in mind, the author discusses the potential importance of more intensive agriculture in Germany as a source of an adequate food supply.

Agriculture of the district of Cleves, H. GÖRTZ (*Landw. Jahrb., 51 (1917), pp. 175–296*).—This article is descriptive of labor problems and prices of agricultural products, systems of land holding and the size of estates, laws of inheritance, credit facilities and loans on agricultural property, trade in farm lands, the size and activity of insurance and other cooperative organizations, opportunities afforded for agricultural training, the amount of land devoted to different crops, methods of cultivation and yields, numbers of live stock, and the extent to which certain technical industries, such as milling, brewing, and distilling, are carried on in connection with farming.

It is said that methods of bookkeeping are comparatively simple except on a very few estates. Figures from three farms on which detailed records have been kept for a number of years are quoted to indicate what the returns of farming were in these presumably representative cases, and how the income may be calculated in any instance.

Mountain forests and pasture lands, A. SERPIERI (In *L'Italia Agricola e il suo Avvenire, II. Rome: R. Accad. Lincei, Com. Sci. Aliment., 1920, pp. 1–88*).—Statistical tables with descriptive notes are presented in part 1 of this study to set forth the area and general characteristics of the mountain regions of Italy, live stock carried, land tenure, and organization of agricultural pursuits, and to present a study of the density and movement of the population and emigration tendency.

Part 2 suggests the development of natural resources of the mountains with special reference to the southern Appennines.

Farm management in Katanga and in the upper Belgian Kongo (*Bul. Agr. Congo Belge, 12 (1921), No. 1, pp. 211, pl. 1, figs. 75*).—Detailed directions are offered for the guidance of farm seekers in Belgian colonial territory in central Africa, as well as descriptions of the country, climate, resources, and native crops and live stock or those adapted to the region.

The Argentine sugar industry and the consequences of its protection, T. C. García (*La Industria Azucarera Argentina y las Consecuencias de su Protección. Thesis, Univ. Nac. Buenos Aires, 1920, pp. 210, figs. 18*).—This study traces the history of sugar production with particular reference to Argentina, discusses past and recent legislation in several countries protecting the industry, and describes methods of cultivating cane, the area in cultivation, production, exportation, capital invested, cost of production, by-products, freight rates, and the classes of laborers employed in cane production and sugar manufacture. Their wages and hours of working and living conditions are covered in detail. A bibliography is included.

Standard cotton mill practice and equipment, 1921, compiled and edited by A. H. Garside (*Natl. Assoc. Cotton Manfrs. Yearbook, 1921, pp. 1–180, figs. 20*).—An article by A. R. Marsh on The Trade in Raw Cotton in 1920 (pp. 7–20) is published here, and statistical information relating to the production, distribution, and prices of cotton and cotton cloths for a number of years in the United States and foreign countries, as compiled by governmental and commercial agencies, is brought together.

Contemporary agricultural law, A. J. Spencer (*Jour. Roy. Agr. Soc. England, 81 (1920), pp. 111–125*).—Attention is directed to the laws and court decisions passed in 1920 affecting agricultural interests in England.

An introduction to English rural history, G. Guest (*London: Workers' Educational Assoc., 1920, pp. 68*).—This booklet offers an historical sketch in 12 brief chapters of the agriculture in early Britain, the growth and decay of the manorial system, the rise of sheep farming and enclosures, rural depopulation, grievances and revolts of the peasantry, the improvements in agricultural methods in the eighteenth century, the passage of the corn laws, and the combination of agricultural labor in village trade unions.

[Agricultural aid], R. P. Wright et al. (*Scot. Bd. Agr. Rpt., 9 (1920), pp. V–XXX, LXIX–LXXXVI, XCVII–CII, 1–23*).—The activities of the board fostering land settlement, cooperation, and other measures for increasing agricultural production are reported on for the year ended December 31, 1920. Appendixes give statistical details.

[Land tenure and settlement, and agriculture in New Zealand, 1920], M. Fraser (*New Zeal. Off. Yearbook, 1920, pp. 187–247, figs. 2*).—These pages continue statistical information previously noted (E. S. R., 43, p. 491).

The Agricultural Holdings Acts, 1908–1914, T. C. Jackson (*London: Sweet & Maxwell, Ltd., 1920, 4. ed., pp. VIII+300*).—This is the fourth edition of the work previously noted (E. S. R., 39, p. 89).

The rent of land and its taxation, H. G. Brown (In *The Theory of Earned and Unearned Incomes. Columbia: Missouri Book Co., 1918, pp. 199–254*).—In this chapter the author argues the case for the taxation of the situation rent of land, which is maintained to be in itself a payment for benefits due not to a service rendered by the owner to society but to increment arising out of natural conditions or social growth. In answer to arguments for "vested rights," he maintains that society is privileged to discriminate in taxation and change its policies as the need arises.

The rent of land and its taxation, H. G. Brown (In *The Taxation of Unearned Incomes. Columbia: Missouri Book Co., 1921, pp. 51–121*).—This essay is a reprint, with changes and additions, of chapter 6 of The Theory of Earned and Unearned Incomes, noted above. Appendixes present suggestions for legal enactments or constitutional amendments especially in States having the initiative and referendum, together with reasons for the proposed program.

The prosecution of the breaking of contracts on the part of agricultural labor, R. Breithaupt (*Landw. Jahrb., 51 (1917), pp. 1–69*).—The laws of

various States and Provinces of Germany and of other nations relating to the breaking of an agricultural labor contract and the penalties attached thereto are listed. The legal status of contract breaking as an act punishable by law and its classification as a civil or criminal offense are treated in considerable technical detail. It is concluded that it belongs to the jurisdiction of both the civil and criminal law, but not of the police law. It is regarded throughout as a crime of omission or of commission by default.

Definition is given of various types of agricultural workers and of labor contracts concerned. The necessity for more uniformity in the penalties fixed for the various classes and in different States is pointed out. One of the principal difficulties in the punishment of contract breaking is said to be that of defining the guilt.

The texts of numerous regulations are given in an appendix, and an extensive bibliography is included.

The minimum wage for farm workers in Scotland, J. WILSON (*Scot. Jour. Agr., 4 (1921), No. 3, pp. 296–310*).—These pages present a discussion of some technicalities of minimum wage adjustment in different districts of Scotland and for classes of farm workers according to training and experience and the skill required by tasks performed.

Agricultural wages in peace and war in the Province of Posen, H. DALSKY (*Landw. Jahrb., 51 (1917), pp. 93–139*).—The material for this paper was assembled in the autumn of 1915 by personal visits to farmers in the districts of Schwerin-on-the-Warthe, Bomst, Schmiegel, and Pleschen in the Province of Posen in Polish Prussia. A statistical study is made of the population, migration, classes of agricultural laborers, hours of working and training, and wages in money and kind before the war, principally in the year 1891, and in 1914.

Agricultural wages, 1915–1920, N. KROSBY (*Tidsskr. Norske Landbr., 27 (1920), No. 12, pp. 472–479; abridged in Internatl. Inst. Agr. [Rome], Internatl. Rev. Agr. Econ., 12 (1921), No. 4, pp. 212–218*).—A number of tables are given with comment, showing the wages received by various classes of agricultural workers in Norway and the percentage of increases in recent years.

Wages of agricultural workers in Italy (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 13 (1921), No. 1, pp. 130–134*).—Certain provisions of collective agreements between landowners' associations and organizations of agricultural workers in several Provinces of Italy are reproduced in these pages.

The part of the American farmer in financing world credit, W. H. BOOTH (*Bul. Pan Amer. Union, 53 (1921), No. 1, pp. 54–61*).—The author discusses the necessity for the purchase of foreign securities in this country, thereby providing the credit necessary to the creation of new markets and outlets for the surplus agricultural production of the United States, and puts upon the farming class the responsibility for improving its own economic condition by producing an exportable surplus rather than depending upon legislation or other uneconomic means.

Recent developments in the Federal farm loan system, G. E. PUTNAM (*Amer. Econ. Rev., 11 (1921), No. 3, pp. 427–437*).—The author reviews briefly the recent litigation which ended in the decision of the U. S. Supreme Court sustaining the constitutionality of the Federal Farm Loan Act. The increase in the number and business of joint-stock land banks is noted. It said, however, that the status of these banks is unsettled and insecure; that it is unfortunate for them, as well as for sound public policy, that the constitutionality of exempting farm loan bonds from Federal taxes has been sustained; and that, at most, they can derive but a temporary benefit from tax exemption,

while for political reasons it may prove to be exceedingly difficult to withdraw this privilege from bonds of the Federal land banks. It is claimed that no valid argument can be advanced supporting the policy of exempting Federal land bank bonds which does not also apply to those of joint-stock banks, and that the evils of tax exemption in a system of progressive taxation are so great that bonds of neither type of bank should be exempt from Federal income taxes.

Cooperation at home and abroad, C. R. FAY (*London: P. S. King & Son, 1920, 2. ed., pp. XVI+447*).—This is a second edition of a volume previously noted (E. S. R., 24, p. 394).

The status of farmers' cooperative associations under Federal law, F. D. JONES (*Jour. Polit. Econ., 29 (1921), No. 7, pp. 595–603*).—This note maintains as the intention of Congress that section 6 of the Clayton Act should legalize certain organizations, including farmers' associations, to protect them against dissolution, but not legalize acts committed by them of a character hitherto held unlawful. Several cases are referred to involving this law in which decisions were rendered exempting farmers' organizations from prosecution under the antitrust laws.

Report of the Irish Agricultural Organization Society, Ltd., for the year ending March 31, 1920, H. PLUNKETT ET AL. (*Irish Agr. Organ. Soc. Rpt., 1920, pp. 137*).—This continues information previously noted (E. S. R., 43, p. 488).

Report on the working of the cooperative societies in Coorg, 1919 and 1920, K. N. SUBBARAYA (*Coorg Coop. Socs. Rpts., 1919, pp. 20; 1920, pp. 17*).—Reports and tabulated statements of progress are made.

Chuch cooperation in community life, P. L. VOGT (*New York: Abingdon Press, 1921, pp. 171*).—The author endeavors to outline some of the conditions and principles involved in and the philosophical basis of community service on the part of the rural church. He suggests methods of adjustment and cooperation between denominations and also between the church and other religious organizations in a definite missionary program.

Principles of marketing, P. W. IVEY (*New York: Ronald Press Co., 1921, pp. V+351*).—Two chapters of this college textbook on marketing processes are devoted to a treatment of problems of the grading, storing, and transportation of farm products, furnishing market news, and the rôle of speculation, especially in the marketing of grains. Various tendencies toward market integration are pointed out in this connection as well as in the selling of other commodities.

Internationalizing the trade in cereals, G. DE MARNEFFE (*Bol. Min. Agr. [Argentina], 26 (1921), No. 1, pp. 88–92*).—The author presents an outline of a proposed plan for pooling the world's stocks of wheat and allotting the surplus to the various importing countries.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 4 (1921), Nos. 9, pp. 129–144; 10, pp. 145–160; 11, pp. 161–176, figs. 6; 12, pp. 177–192, fig. 1*).—Abstracts of information on supplies, the domestic movement, imports and exports, and the situation in the market of specified commodities and the important classes of agricultural products are presented in these numbers covering the period up to about September 10. Special articles are included summarizing or analyzing aspects of market conditions with reference to special regions or commodities.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 9, pp. 105–120, fig. 1*).—The usual monthly estimates of acreage, condition, and yields of crops, with summaries and comparisons over periods of years, as well as data relating to farm value and prices received for farm products, and re-

ports of supply and prices of live stock are presented in this number. Average prices paid by farmers July 15, 1921, for certain supplies and equipment are tabulated. A tabulated report of the surplus of imports over exports, 1911–1920, in the meat trade of specified European countries is also presented.

Price Current-Grain Reporter Yearbooks 1920 and 1921, E. G. OSMAN (*Price Current-Grain Rptr. Yearbooks, 1920, pp. 112; 1921, pp. 112*).—This number continues information previously noted (E. S. R., 41, p. 492).

Idaho agricultural review, J. H. JACOBSON (*Idaho Crop Reporting Serv. Bul. 16–17 (1921), pp. 48, figs. 15*).—Historical and comparative statistical information and estimates by assessors and crop reporters of the acreage and production of crops in Idaho in 1920 are brought together under the direction of State and Federal officials cooperating.

[Agricultural statistics of British colonies] (*Brit. Oversea Dominions and Protect., Statis. Abs., 54 (1903–1917), pp. 338–400*).—These pages continue abstracts of colonial statistics relating to agriculture and live-stock production previously noted (E. S. R., 41, p. 295.)

The Department of Statistics [of Denmark], 1896–1920, A. JENSEN (*Det Statistiske Departement, 1896–1920. Copenhagen: Govt., 1920 pp. 200*).—A résumé is given of the collection and publication of official statistics in Denmark during the last 25 years.

[Agricultural production in Algeria], J. B. ABEL ([*Gouvt. Gén. Algérie*] *Exposé Situation Gén. Algérie, 1920, pp. 426–602, 740–926*).—These pages continue reports of returns of principal crops and other information as previously noted (E. S. R., 44, p. 91).

[Agricultural statistics for China], H. T. M. BELL and H. G. W. WOODHEAD (*China Yearbook, 1919, pp. 39–62*).—These pages of the annual report offer brief statements concerning the localization of the principal agricultural crops, domestic and foreign trade in agricultural products, and the uses to which they are put.

The agricultural and commercial statistics for 1921, K. MIURA (*Japan Dept. Agr. and Com., Agr. and Com. Statis., 1921, pp. [3]+7+172*).—This is the first volume of a series of separate statistical reports in English relating to agriculture, commerce, fisheries, mines, forests, and other subjects for Japan, and also Chosen, Taiwan (Formosa), Japanese Sakhalin, and certain territories in the Kwangtung Peninsula.

Area, classification of area, area under crops, live stock, and land revenue assessment, and transfers of land in British India, D. N. GHOSH (*India Agr. Statis., 35 (1918–19), I, pp. [4]+X+321, pls. 6*).—This volume continues annual statistics and summaries as previously noted (E. S. R., 43, p. 492).

AGRICULTURAL EDUCATION.

[Professional preparation of rural teachers], W. S. LEARNED, W. C. RAGLEY, ET AL. (*Carnegie Found. Adv. Teaching Bul. 14 (1920), pp. 173–177, 361–364*).—In these pages of a study based upon an examination of tax-supported normal schools in the State of Missouri in 1914 and years following, there is to be found an analysis and evaluation of professional courses dealing with rural life problems and rural school management which have been or are being offered in teacher-training institutions of the State. The purpose was to determine the function each is intended to discharge under the theories now apparently governing curriculum organization in Missouri schools.

The report indicates briefly also the number of teachers in rural schools and the general level of their training and experience.

Mathematics for students of agriculture, S. E. RASOR (*New York: Macmillan Co., 1921, pp. VIII+290+[1], figs. 193*).—A year's work in mathematics for students taking agricultural courses in secondary, vocational, and technical schools and in colleges and universities is presented in this textbook. Material for study and practice in basic elementary processes of arithmetic, algebra, and geometry is included in order to supplement the preparation of certain students and to provide review for others. Throughout it is attempted to make the principles of arithmetic, algebra, geometry, trigonometry, and graphic representation function with the student's interest and point of view. Computing tables printed in the appendix are adapted to the examples and illustrations given in the text.

The jute industry, T. WOODHOUSE and P. KILGOUR (*London and New York: Sir Isaac Pitman & Sons, Ltd., 1921, pp. X+133, figs. 50*).—A manual designed for the use of textile students. The different processes involved in the jute industry from the culture of the crop to finishing the cloth are described and illustrated.

Outline for the teaching of nutrition in elementary grades (*Detroit, Mich.: Merrill-Palmer School, 1921, pp. 83*).—Outlines of lessons intended to teach the function and importance in the child's diet and the care and preparation of milk, eggs, cereal grains, fruits and vegetables, and meat and meat substitutes are offered as suggestions for teaching nutrition in connection with physiology and hygiene in the grade schools.

MISCELLANEOUS.

Report of the Dominion Experimental Farms, 1920, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpt. 1920, pp. 198*).—This contains the reports of the director, the Dominion specialists, and the superintendents of the various substations for the fiscal year ended March 31, 1920. In addition to experimental work abstracted elsewhere in this issue, meteorological data are included.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 4 (1921), No. 1, pp. 29, figs. 6*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Feeds and Fertilizer Analyses, by A. J. Patten; External Parasites of Poultry, by W. E. Newlon; Improvement of Rosen Rye, by J. F. Cox; and Care of Cows Before and After Calving, by J. E. Burnett.

NOTES.

Alabama College and Station.—The main agricultural building, which was destroyed by fire in October, 1920, is being rebuilt and will be ready for occupancy about January 1, 1922. It is planned to house the administration offices and the departments of agronomy, botany, entomology, and horticulture, and the third floor will be given over to the extension offices.

A sweet potato storage house has been completed on the campus for the horticultural department. This is a structure 20 by 80 ft., with a capacity of 3,000 bu.

F. E. Guyton of Ohio State University has been appointed assistant professor of zoology and entomology.

Connecticut State Station.—Dr. G. H. Chapman, formerly of the Massachusetts Station, has been added to the station staff in charge of tobacco work. Harry J. Fisher has been appointed an assistant chemist.

Florida Station.—Recent appointments include William E. Stokes as grass and forage crop specialist and William G. Wells as assistant plant pathologist.

Hawaii University.—F. G. Krauss, who has been in charge of the extension work of the Haiku Substation of the Federal Experiment Station, has been appointed professor of agronomy.

Idaho University and Station.—The beef cattle barn was burned November 16, causing damage estimated at $20,000, partly covered by insurance. All of the $20,000 herd of purebred cattle, except one bull, were saved.

A. E. McClymonds, extension agronomist of the Colorado College, has been appointed superintendent of the Aberdeen Substation farm, vice L. C. Aicher, whose resignation has been previously noted. F. W. Atkeson has been appointed head of the department of dairy husbandry and F. E. Armstrong professor of agricultural education and principal of the school of practical agriculture.

Louisiana Stations.—The station laboratory building at Baton Rouge, together with all equipment, records, etc., was destroyed by fire on the night of November 3. The director's office was also partly burned, but the furniture, records, and the director's library were saved. The loss was partly covered by insurance.

Owing to the fact that the university will be moved to the new site below Baton Rouge as soon as possible, only temporary quarters will be provided on the present location. A temporary frame structure, to cost about $2,500, will be erected at once to house the departments of plant pathology, animal pathology, and entomology.

Michigan College and Station.—The State corporation tax law, passed by the last legislature, has been declared constitutional by the Michigan Supreme Court, reversing lower tribunals. Under this decision, which is to the effect that under the constitution of 1907 all new sources of taxation are open to the State for general purposes, the college is to receive the large funds appropriated for the library and administration building and the home economics building.

The resignation, effective January 1, 1922, is noted of A. M. Brown, secretary of the institution for 25 years. E. C. Foreman, extension specialist in poultry, has been appointed associate professor in poultry husbandry and head of the poultry department, effective December 1.

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